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JUNE

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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EDITORIALS
Contribution of Clinician to Research
A Great Need

COUNCIL ON DENTAL THERAPEUTICS
Local Anesthetics

BUREAU OF PUBLIC RELATIONS
Cincinnati Mouth Hygiene Campaign

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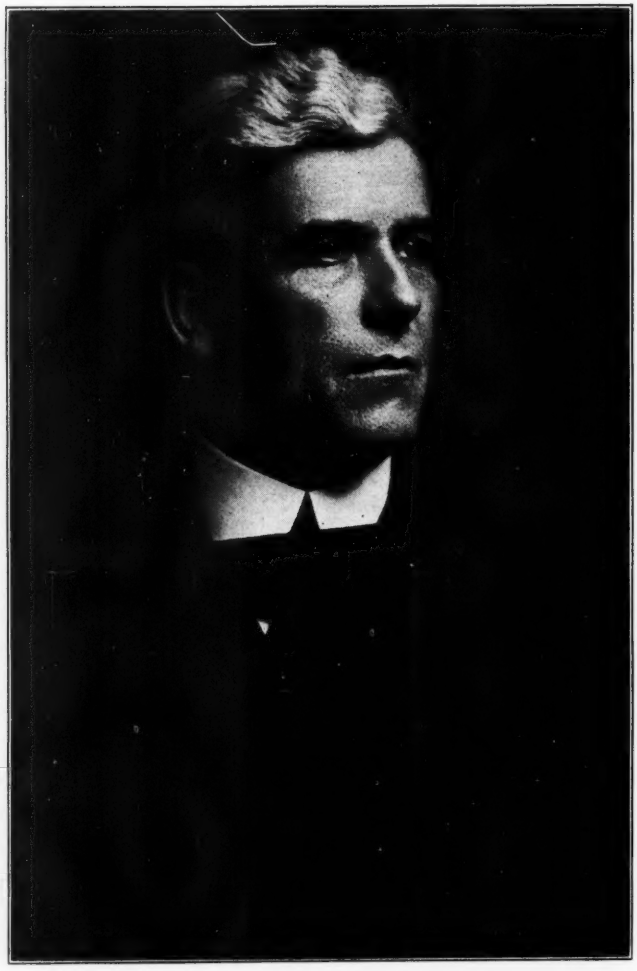

ALBERT E. WEBSTER, D.D.S., Toronto, Canada
Recipient of the William Jarvie Fellowship Medal, 1932

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Original Communications

WHAT DO WE KNOW ABOUT DENTAL CARIES? (A CRITICAL REVIEW OF RECENT INVESTIGATIONS)*

By ROBERT G. KESEL, D.D.S., Chicago, Ill.

I AM of the opinion, as a result of a review of the recent investigations on dental caries, that many investigators are prone to develop interesting theories concerning its etiology and then become so imbued with their idea that they see only those facts which support their premature conclusions, completely ignoring or being ignorant of diverse facts shown by their own experiments or facts already established by others. They are not content with publishing for the benefit of other investigators the results which their experiments have given them, but publish their unsupported hypothesis as well. These are accepted with full credence by many of the profession and are often given wide publicity in the press and in magazine articles.

A few years ago, because of the studies of W. D. Miller, J. Leon Williams and G. V. Black, bacteria were considered largely responsible for dental caries; but during the past decade, largely because of the discovery of vitamins and the development of nutritional chemistry, bacteria have been relegated to a position of minor importance and emphasis has been placed on the effect of metabolism on the teeth.

There has developed a variance of opinion as to just how metabolism predisposes the teeth to caries. In this review, I have placed the investigators in three groups. I shall consider first those who believe diet and metabolism influence and alter the tooth substance during the life of the individual. The second that I shall consider are those who feel that changes in the salivary secretion are responsible. The third group comprises those who are still of the opinion that bacteria are the specific cause, influenced perhaps by food débris about the teeth.

Much of the writing in dental literature has little scientific evidence to support its claims, theories being advanced which are not and perhaps never could

*Read before the Odontographic Society of Chicago, Feb. 1, 1932.

be supported by proof. Such writing I shall not mention, confining this discussion to a more or less critical analysis of those articles whose authors have attempted to substantiate their claims by experimental evidence.

Mrs. May Mellanby, of England, who has done an immense amount of experimental work on the caries problem, falls in the first group.[1] She became interested in this study in 1917 through the observation made by her husband, Edward Mellanby, that dogs fed rachitic diets developed certain abnormalities of the teeth. Since that time, she has published the results of the experimental feeding of about 1,500 dogs, 700 rabbits, a large number of rats and, on a lesser scale, institutional children. Mrs. Mellanby is of the opinion that the tooth substance in itself is of prime importance in immunity or susceptibility to caries. In a recent article, she makes herself definite on this issue, stating that the results of her experiments suggest that "the problem of dental caries and periodontal disease is fundamentally a problem of nutrition" and that "diet influences the teeth specifically, not so much by a direct action in the mouth as by influences brought to bear on the developing or developed teeth after the food has been digested and absorbed, and by its products carried in the blood stream to the dental and other tissues."[2]

She believes that the high incidence of caries in children is associated with defective structure, and by defective structure she means not only gross, macroscopic defects such as pits and fissures, but likewise microscopic imperfections as evidenced by interglobular spaces. The conditions responsible for these developmental defects are: (1) lack of sufficient vitamin D in the diet; (2) low calcium intake accompanied by vitamin D deficiency, and (3) the consumption of large amounts of cereals because, in her opinion, they have an anticalcifying power.

She states that the practical solution of this problem is not in attempts to eliminate environmental conditions favorable to infection, but in the establishment of sound structure and resistance in the dental tissues themselves.

In the light of Mrs. Mellanby's own experimental evidence, I seriously question her right to that belief. By her dietetic work, she has been able to produce any degree of structural imperfection in the dog's tooth, and such imperfections, according to her own statement, greatly resemble those found in human teeth. She believes that the conditions which control the structure of the dog's teeth are similar to those that control tooth structure in man and other animals. She implies that she has been able to alter the resistance of the teeth by changing ingredients in the diet. She has found that dog's teeth immersed in a broth culture of saliva decalcify and disintegrate exactly as do man's; and yet, in all her studies, she has only twice produced dental caries in the dog.[3] The enamel in these teeth was of good structure, the dentin somewhat defective. In both of these instances, artificial cavities had been cut through the enamel into the

1. (*a*) Mellanby, May; Pattison, C. L., and Proud, J. W.: Brit. M. J., 2:354-355 (Aug.) 1924. (*b*) Mellanby, May, and Pattison, C. L.,: Brit. D. J., 47:1045-1057 (Oct. 1) 1926; (*c*) Brit. M. J., 2:1079-1082 (Dec. 15) 1928; (*d*) Mellanby, May: M. Res. Council, Rep. No. 140, 1929; (*e*) No. 153, 1930; (*f*) No. 159, 1931; (*g*) Experiments on Dogs, Rabbits and Rats, and Investigations on Man Which Indicate Power of Certain Food Factors to Prevent and Control Dental Disease, J. A. D. A., 17:1456-1480 (Aug.) 1930.

2. Footnote 1, seventh reference (*g*).

3. Footnote 1, fifth reference (*e*).

dentin, and it was the dentin at the base of these cavities which became involved. It so happened that both of these dogs were on a vitamin A and D deficient diet.

Is it not significant from her observations that there was some other factor or factors besides tooth structure in the marked immunity of the dog to caries? It might be argued that the dog's dental arch with teeth spaced so that contacts are open; the conical teeth with their broadest diameter at the gingival margin, and the marked salivation characteristic of the dog produced environmental conditions inhibitory to caries despite the structural imperfections.

Mrs. Mellanby makes some interesting statements in regard to her selection of animals for experimental work. After considering several factors in the problem, she chose the dog, largely because he could be kept healthy under laboratory environment and because he was omnivorous, eating and living as a member of man's family. The objections to the dog were that his denture was unlike man's and that he was not liable to caries. She states that monkeys would have been ideal in that their denture more closely resembles that of man than does any other animal's and, likewise, they are susceptible to caries even in their native state; but one of the reasons that they were not used was that their diet differs considerably from man's in that they are almost strictly vegetarian. Yet Mrs. Mellanby reasons that diet is largely responsible for caries, although the dog, who has adopted man's diet, is immune; while the monkey, who differs in his dietary, is susceptible.

In her experimental work with rabbits, she has been able to produce in some a softening of the dentin on the abraded occlusal surface with bacteria invading the tubules in these areas.[3] This, she claims, simulates caries. The work is interesting but is not comparable, in my opinion, to what occurs in human teeth. In the first place, the rabbit's molars are continually growing from persistent pulps, which eliminates them from comparison with human teeth. In the second place, the described condition occurs only in abraded areas from which the enamel has worn away, leaving the dentin exposed. In human teeth, how often do we find caries on an abraded surface?

Mrs. Mellanby has been disappointed in her rat experiments, as I have been, in that the incidence of caries in these animals is much less than the statements of other investigators would lead one to believe. While macroscopic lesions have been produced in some, the histologic picture differs in that bacteria are not always seen invading the dentinal tubuli.[3]

She has carried her investigations to children living in institutions. The results of the first two years of study have been published recently by the Medical Research Council.[4] A total of 332 children have been under observation. They are divided among three different institutions, but the living conditions are much the same in all. Only one addition was made to the diets. In one institution, treacle (molasses) was added, in the second, olive oil, and, in the third, cod-liver oil. Examinations during the two-year period have revealed that the incidence and extent of caries in the cod-liver oil group has been appreciably lowered.

Mrs. Mellanby's experimental work has been highly scientific and her findings are important, but her hypothesis lacks proof.

Drs. Boyd and Drain and their coworkers at the University of Iowa have made some most interesting observations

4. Footnote 1, sixth reference (*f*).

on the arrest of dental caries in children.[5] Dr. Drain, the dentist of the group, noticed, in the routine mouth examinations given children in the hospital, that now and then arrested caries was found. A study of these children, twenty-eight in all, revealed that they were diabetic and had been on the routine diabetic diet for a period of weeks. Caries had been active in their mouths when they entered the hospital, but after diabetic control had been established, farther invasion was checked and no new cavities developed. These children, besides receiving a diet rich in minerals and vitamins, were receiving insulin and were deriving much of their energy from fats instead of from carbohydrates.

To eliminate the insulin factor, four nondiabetic children in the orthopedic ward of the hospital were placed on the same diet but were not given insulin. All had active caries as evidenced by soft, spongy cavities in the dentin. They were kept on this diet for about two months and, in every instance, caries was arrested; that is, the dentinal surface changed from its initial state to one of stony hardness. Two of these children returned to the old hospital diet and were followed for several months. Both again developed active caries.

Then a group of five children of preschool age, living at home, were studied. With the parents' cooperation, they were placed on a strict dietary régime. In ten weeks, caries in all was completely arrested. These children received carbohydrates in liberal quantities, whereas the other two groups did not.

They next observed a group of four girls suffering from celiac disease. In this disease, the tendency toward caries is great. Because of the inability of these girls to absorb much fat or carbohydrate, simple sugars and proteins were used as the source of nutrition. These children were under observation for three years and caries was found to be completely inhibited.

While the diets of these groups have differed in that some were high in fat and others in carbohydrates, the essential features of the diet were much the same. Each received cod-liver oil, milk, orange or tomato juice, vegetables and fruit. Boyd and Drain feel that while these substances are present in the diets of many of our children, they are not present in sufficient quantities, or, if they are, the child selects according to his liking, leaving much of some for other less essential dietary factors.

From their observations, Boyd and Drain are of the opinion that not one dietary factor is responsible for immunity to caries but that an adequacy of all the essential factors, especially vitamins and mineral elements, is the necessary requirement. They likewise believe that the progress of caries is influenced by structural changes in the tooth which result from metabolism. They state: "With a correction of conditions leading to metabolic disturbances, the teeth should develop resistance to caries."[6] They hint that the dentin is not primarily softened by bacterial action, but by the mobilization of calcium from the teeth, and that by the lowering of the physiologic integrity of the dentin, bacterial invasion is permitted. They make the following statement: "It is well known that calcium is readily mobilized from the bones and teeth when needed for the regulation of mineral metabolism,"[6] but they do not support this statement with reference to

5. Boyd, J. D., and Drain, C. L.: J. A. M. A., 90:1867 (June 9) 1928. Boyd, J. D.: Drain, C. L., and Nelson, Martha V.: Am. J. Dis. Child., 38:721-725 (Oct.) 1929.

6. Footnote 5, first reference.

any authority. Undoubtedly, they have authority for the assertion in regard to bone, and perhaps to dentin, but to my knowledge such changes have not been shown to occur in the enamel. They have fallen into the fallacy of considering bone and enamel analogous, forgetting that the enamel of the erupted tooth has lost its formative organ.

In fact, in their theory, they have some difficulty in getting the carious process through the enamel and into the dentin. From some of their published statements, I have become somewhat confused as to just what they consider dental caries to be. They state that "it is generally conceded that a break in the continuity of the enamel is a primary requisite."[6] Again, in reporting on the bacteriology of three mouths during the arrestment of the carious process, they say, "A fourth child, with no dentinal caries but with decalcification of the gingival enamel, was included in this study."[7] Do they believe that true caries occurs only in pits and fissures, where there is perhaps a break in the continuity of the enamel, and that the decalcification occurring on smooth surfaces in gingival thirds and proximal areas where there is perhaps no break in the enamel is not dental caries? If so, one of the basic premises of their hypothesis is at variance with accepted facts.

They have studied the mineral content and the hydrogen-ion concentration of the saliva in seventeen diabetic children who developed arrested caries and have compared the analysis with that from thirteen nondiabetic children who had a high incidence of caries. The variations in the calcium, phosphates, chlorids and hydrogen-ion concentration of the saliva in both groups were comparable, and so they conclude that the arrest of caries is not due primarily to any marked differences in mineral content of the saliva.

It is interesting to note that, with the cessation of caries in the mouths of the children on a diet, the occurrence of salivary calculus deposits on these teeth was almost universal and it recurred rapidly after its thorough removal. According to their own statements, salivary calculus is unusual in the mouths of children. They claim to have altered the tooth substance, but is this not evidence that they have also altered the tooth environment?

In regard to the bacteriologic study mentioned above, only four mouths were studied, three with active caries which became arrested and the fourth with the gingival decalcification. Cultures were made at the beginning and during the dietary treatment until after caries was arrested. Inoculum was obtained by scraping the gingival surfaces of the teeth and placed in suspension in salt solution. Then, a definite amount was inoculated into dextrose broth and incubated forty-eight hours. It was then tested colorimetrically for acidity. Smears were also made, but no mention is given of the type of organisms found. Forty-eight hours' incubation is hardly sufficient to determine the potential acidity of the flora, but because there was no significant change in the potential acidity of the cultures before and after the caries was arrested, the conclusion is drawn that dental caries is not primarily dependent on the production of acid in the mouth. A more proper conclusion from their experiment would probably be that dental caries is not primarily dependent on the ability of the flora to produce acid in the test tube.

This study of Boyd and Drain gives

7. Magee, C.: Drain, C. L., and Boyd, J. D.: Proc. Soc. Exper. Biol. & Med., 26:718-719 (May) 1929.

real evidence that a well balanced diet does in some way affect the welfare of the teeth. Of course, their experiments have been conducted on a rather small scale, less than fifty children being studied, and most of them hospital patients. Nevertheless, a well-managed experiment conducted on a small scale has greater scientific value than an experiment involving large numbers but not well managed nor properly controlled.

Percy R. Howe, of Boston, is another exponent of the vitalistic theory of caries.[8] He believes that teeth are modified bone and that the pulp not only presides over the calcification of the forming tooth but also continues its activity throughout life. He attempts to show that "by its (pulpal) action, calcified teeth may soften, and by a reversal of the process there may occur recalcification."[9]

He likewise states that proper diet "preserves the healthful activity of the pulp, and enables it to maintain that intimate union of the organic and inorganic components of the tooth which constitutes an impregnable structure, and assures immunity to decay."[9]

What evidence does Howe offer to substantiate his contention? He cites the changes which have been observed to occur in the pulps and dentin of the guinea-pig on a scorbutic diet and apparently offers that as evidence of what occurs in human teeth. According to his guinea-pig experiments, extensive decalcification of the teeth and some parts of the bones was produced by scorbutic feeding. In fourteen weeks, teeth were extensively decalcified and alveolar processes destroyed. By alternating the scorbutic diet with an adequate diet, he was able to produce decalcification and recalcification in the bone and teeth. He was also able to mark the enamel by the alternate feedings. But remember, guinea-pigs' teeth are continually growing, and disturbed metabolism might be expected to produce disturbed development and calcification in such teeth.

He has fed guinea-pigs diets containing various metallic salts and has been able to demonstrate these metals in the pulps of the teeth thirty minutes after ingestion and in the dentin after twenty-four hours. But he has not shown the metals to be present in the enamel. Evidently, pulpal activity may influence the dentin in the guinea-pig, and possibly it does so in man, but the initial lesion of caries appears in the enamel, and Howe has shown no evidence of enamel change by pulpal activity.

On the contrary, Gies has shown that in puppies injected with trypan blue during the entire period of enamel formation, all of the tissues became blue.[10] When the injections were discontinued, all tissue returned to normal except the enamel. This blue in the enamel, produced by a water-soluble dye, remained throughout the life of the dogs. One dog was observed for eight years.

Howe has conducted experimental feeding on monkeys and has placed them on scorbutic diets in attempts to produce dental caries, presumably through pulpal

8. Howe, P. R.: (*a*) D. Cosmos, 62:586-590 (May); (*b*) 921-929 (Aug.) 1920; (*c*) 63: 1086-1092 (Nov.) 1921; (*d*) J. Dent. Res., 3:7-37 (March) 1921; (*e*) J. A. M. A., 79:1565-1567 (Nov. 4) 1922; (*f*) Studies of Dental Disorders Following Experimental Feeding with Monkeys, J. A. D. A., 11:1149-1160 (Dec.) 1924; (*g*) D. Cosmos, 68:33-35 (Jan.), (*h*) 1021-1033 (Nov.) 1926; (*i*) Investigations of Dental Caries, J. A. D. A., 14:1864-1866 (Oct.) 1927; (*j*) Practical Nutritional Suggestions, ibid., 17:2140-2143 (Nov.) 1930; (*k*) American Magazine, October, 1930, p. 45.

9. Footnote 8, ninth reference (*i*).

10. Gies, W. J.: Studies of Internal Secretions in Relation to Development and Condition of Teeth, J. N. D. A., 5:529 (May) 1918.

alterations.[11] Forty-six animals were included in the experiment. Of this number, thirteen developed caries. Five of these had been on a pronounced scorbutic diet, five had received 10 c.c. of orange juice daily and three had received from 30 to 40 c.c. of orange juice daily. Results show that many of the animals on the marked scorbutic diet developed no caries and that several receiving orange juice, three as much as 30-40 c.c. daily, did develop caries. In fact, more animals receiving orange juice developed cavities than did animals not receiving it. He concluded from his results that vitamin C alone is not the sole dietary factor of importance but that others are the amount of calcium, of phosphorus, of protein and of indigestible residue. That was his opinion in 1924.

In a recent issue of the *American Magazine,* which goes into many homes in this country, an interview with Howe is published.[12] He is quoted as making these statements: "Drink a pint of orange juice a day and you'll forget what a dentist's chair looks like . . . Decay of teeth is not, as many people still believe, caused by bacteria. It is a form of bone degeneration resulting from improper food, food lacking in mineral salts, and the mysterious vitamin C . . ." I realize that it is dangerous to quote from such a source. Perhaps Howe did not mean these statements as they sound; but over a year has elapsed, and they have not been corrected. I do not believe such statements should be given the public for misinterpretation.

Milton T. Hanke, of the University of Chicago, has championed vitamin C as a most important factor in dental disease.[13] Hanke first attached significance to vitamin C as a result of a study of 191 people. These people were placed in four groups: (1) those with no present dental disorders; (2) those with caries; (3) those with caries and pyorrhea or gum inflammation, and (4) those with no caries but with pyorrhea. He then correlated their diets with their condition. There were seventeen people in the first group and he states that all but one were receiving sufficient vitamins. One boy in poor health was eating a diet unquestionably deficient in vitamin C, but his mouth showed no dental disorders. In all the other groups, each person was eating a diet deficient in vitamin C. Some were likewise deficient in vitamin D, but many were eating it in sufficient quantities.

Hanke does not state how these diets were analyzed or how the data were obtained. I assume, therefore, that the patients were questioned concerning their food habits. If any of you have attempted to question a patient concerning his diet you know how difficult it is to obtain an accurate idea of what was eaten over a significant period of time. It is most difficult to learn the amounts of the food substances ingested. Such observations, then, cannot be accurate or dependable.

Nor does Hanke mention the basis upon which he determined what constituted a vitamin C deficiency. He later determined that from a half pint to a pint of orange juice daily produced the greatest improvement in oral conditions. Likewise, he observes that Eddy[14] found 3 c.c.

11. Footnote 8, sixth reference (*f*).
12. Footnote 8, eleventh reference (*k*).

13. Hanke, M. T.: Relation of Diet to Caries and Other Dental Diseases, J. A. D. A., 16:2263-2271 (Dec.) 1929; Relation of Diet to General Health and Particularly to Inflammation of Oral Tissues and Dental caries, ibid., 17:957-967 (June) 1930; J. Nutrition, 3:433-451 (Jan.) 1931.
14. Eddy, W. H.: Am. J. Pub. Health, 19: 1309-1320 (Dec.) 1929.

of orange juice a day necessary to prevent pulpal changes in a 1-pound guinea-pig. Its equivalent would amount to 450 c.c. or 1 pint for a 150-pound man. These considerations, then, I assume, gave Hanke the amount upon which he based the foregoing data, and thus he determined that the 170 or more subjects who were suffering from dental disorders were also suffering from a vitamin C deficiency. They were not ingesting from one-half to one pint of orange juice or its vitamin C equivalent a day; which reminds me of a question for which I suppose there is an answer: "Where does the Eskimo, noted for his dental perfection, receive his daily pint of orange juice or its vitamin C equivalent?"

While Hanke believes that vitamin C is a most important factor in tooth preservation and that it is conspicuously lacking, especially in quantity, in most diets, other food essentials are also important. He reports that about 500 patients are under his dietary supervision.[15] The diet consists of milk, fresh vegetables, lettuce, eggs, from one-half to one pint of orange juice and whatever else the patient may choose. One hundred four of these people have been closely followed and marked improvement has been noted in the mouth condition of those who cooperated. Sixty patients who had been in a state of active caries developed no new cavities, and there was no increase in the size of the unfilled lesions during eight months of observation. This seems to be further evidence that a well-fortified diet in some way improves the condition of the teeth.

Recently, Hanke conducted an experiment at Mooseheart, Ill., on about 300 children. A more ideal place to conduct a well-controlled dietary experiment on human beings does not exist. All the results of the experiment have not as yet been published, although they have been presented before dental and medical bodies. The diets of these children were found to be quite adequate in all respects except in the amount of vitamin C. The children were examined at the beginning of a so-called control period. All carious cavities were recorded and filled. A year was allowed to elapse during which the children had no dental attention and partook of the routine diet. The mouths were again examined, and the number of cavities which developed during this period were noted and filled. Then one pint of orange juice daily was added to their diet and the children were permitted to go another year without dental attention. They were again examined and the number of cavities which developed during this experimental period compared with the number that had developed during the control. About 15 per cent developed more caries than during the control period, while about 35 per cent developed only one or two cavities; but because about 50 per cent of the children did not develop a cavity during the experimental period, Hanke seems quite convinced that the orange juice was responsible for its inhibition.

Such conclusions are not well founded, in my estimation. I do not believe that the experiment was properly controlled and conclusions cannot be drawn from uncontrolled data. In the first place, the children at Mooseheart do not develop much dental caries. Their dentist reports that on the average of two to three cavities are filled for each child per year. This is supported by the fact that, during the control period, about 35 per cent did not develop any caries and most of the remainder had only one, two, or three cavities form. The dental report likewise shows that children entering Moose-

15. Footnote 13, second reference.

heart have on the average of eight cavities, which are filled at that time. Children enter Mooseheart at a fairly early age. Most of the children in Hanke's group were 12 years of age or over. They had received yearly dental attention before the experiment was begun. At the beginning of the control period, all cavities were filled, as were the cavities that developed during the control period. Thus, when the orange juice experiment was started, quite a few of the susceptible areas in the susceptible mouths had already been filled.

Should we not expect fewer cavities to develop in these mouths during the second year, regardless of the orange juice? It would have been interesting to keep these children under observation for another year after the orange juice had been dispensed with. Would the incidence of caries have increased? Hanke mentions a control group, which did not receive orange juice, and which was under observation simultaneously with the experimental group, but as yet he has not analyzed the results in this group. Yet a comparison of these two groups, provided they were of equal number and similar age range, would be to me of much greater significance than a comparison of the same persons during two different years of their lives.

Dr. Hanke's paper is as yet unpublished. When it is, I shall perhaps find that I have made some mistakes in my figures; if so, I will apologize; but I believe I am approximately correct from notes that I have taken at his lectures.

The belief that the saliva is the controlling factor in the caries mechanism has had many advocates. H. P. Pickerill, of England, is one who thinks that the saliva, influenced perhaps by diet, has an important and beneficial effect on the teeth.[16] He points out a fact that many other investigators in this field overlook, that is, that it is just as important to determine the rate of flow of the saliva as it is to determine its chemical constituents. For example, an analysis of saliva might show it to contain 5 per cent of a certain substance; but, if the rate of flow was only 1 c.c. a minute, this substance would not have so much influence as it would have in a concentration of 2 per cent but entering the mouth at the rate of 5 c.c. a minute. Pickerill studied the immunity of the Maori children and found that the total alkalinity a minute of their saliva was six times greater than in European saliva. He also found that the ptyalin index in the Maori saliva was more than two times as great. His observations have not, to my knowledge, been substantiated by other investigators.

Robb, Medes, McClendon, *et al.*, of Minneapolis, are inclined to believe that the alkaline reserve of the saliva tends to preserve the teeth by neutralizing lactic acid in the mouth.[17] They conducted scorbutic feeding of guinea-pigs and found the same pulpal and dentinal changes as did Howe and others, but did not draw similar conclusions. They studied the effect of antiscorbutics on human saliva and found that the alkaline reserve was greatly increased ten minutes after the ingestion of an antiscorbutic. Lemon increased it most. Antiscorbutics and acid ions in the diet increased the alkaline reserve. Sugar caused a decrease, as did diets which leave an acid ash in the tissues. Their observations are interesting and would bear further investigation and confirmation.

One of the most active advocates of the

16. Pickerill, H. P.: Brit. D. J., 45:1394-1401, 1924.

17. Robb, E. F., et al.: J. D. Res., 3:39-61 (March) 1921.

importance of salivary conditions in recent times is H. F. Hawkins, of Southern California.[18] He defines dental caries as "the molecular disintegration of the hard substances of the teeth by unneutralized acids of fermentation, due to a lack of basic or acid neutralizing salts in the saliva."[19] He is of the opinion that the density of the interprismatic substance is a factor in immunity, it being more dense in immune than in susceptible teeth. This increased density is due to a precipitation of the calcium content of the saliva into the intercementing substance.

Some other observations of his are these: No matter how hard the teeth may be, they cannot long resist the wrong oral environment. Saliva in itself cannot become sufficiently acid to produce decalcification. "Carbohydrates are without doubt the only class of foods that can produce a local concentration of acid sufficient to cause rapid decalcification of the teeth."[19]

Some carbohydrates are more deleterious in the mouth than others. Cereals are the worst offenders. ". . . wheat-eating people have more trouble with tooth decay than the corn-eating races. In the United States, the corn-eating districts have a higher percentage of immune individuals than the wheat-eating sections."[19] But Hawkins makes no reference to where statistics from such a survey may be found. He continues that the dangerous element in cereals, especially wheat, is its gluten content. This, so he says, is insoluble in saliva and, because of its sticky or gluelike consistency, it adheres to the teeth and holds with it the incorporated starch granules. These are acted on by bacteria and are broken down to lactic acid while held in direct contact with the teeth.

He has analyzed the saliva of more than 100 persons for acidity and calcium content by methods which are open to argument from a biochemical standpoint. He assumes from these findings that an individual obtains immunity from the alkaline and calcium content of saliva, either one acting as a neutralizer for the acids of fermentation. The greater the the calcium content of the saliva, the less the alkalinity necessary. He further states that while the neutralizing value of the saliva can be accurately measured, the acids of fermentation cannot be, and it is therefore difficult to say just how much neutralizing power is necessary to produce immunity. But, remember, according to Hawkins' own theory, the damaging acids are developed under a sticky, insoluble plaque, probably just as impervious to the penetration of the neutralizing saliva as it is to the escape of the confined acid. He, too, cites experiments on patients suffering from active caries who, when placed on improved diets, developed an increased neutralizing power of the saliva and an arrest of caries.

Henry Klein, of McCollum's laboratory at Johns Hopkins University, is a still more recent exponent of the idea that the condition of the saliva, altered perhaps by dietary deficiencies, is a factor in dental caries.[20] He has recently published statements indicating that, at least in rats, the phosphorus content and the calcium: phosphorus ratio of the diet is most significant. If the calcium in the diet is low and the phosphorus is high, caries is not likely to develop. On the other hand, when calcium is high in comparison to phosphorus, caries usually occurs. The

18. Hawkins, H. F.: Dental Decay—What It Is and Means for Its Control, J. A. D. A., 16:781-795 (May) 1929; What Is Cause of Caries and Systemic Pyorrhea? ibid., 18:943-945 (May) 1931.

19. Footnote 18, first reference.

20. Klein, Henry: Science, Dec. 25, 1931, pp. 662-664.

proper ratio is estimated as three parts calcium to four parts phosphorus.

Preliminary to a discussion of Klein's work, I might mention some of the observations made in 1922 by McCollum, Simmonds, Kinney and Grieves in this same laboratory.[21] In a study of the gross maxillary and dental defects produced in 220 rats on defective and deficient diets, they concluded that the composition of the diet was of profound significance both in forming and in maintaining good teeth; *how* they did not know. They stated that, at that time, it was not possible to name any one deficiency which specifically caused dental or oral disease. Their results showed that use of a diet low in calcium but rich in vitamin A resulted in development of the least amount of caries. At that time, vitamin D had not been differentiated. A diet low in both calcium and the A factor produced the greatest amount of caries. The calcium and phosphorus content in these diets was practically identical. A diet high in calcium, as compared to one high in phosphorus, produced an intermediate amount of caries.

Klein, who has analyzed diets which have been fed by other workers, claims to have found that the diets which produced caries were unbalanced in regard to calcium and phosphorus. In an unpublished paper read before the Chicago Dental Society, he points to an experiment performed by Howe in which monkeys fed a certain diet developed caries despite the ingestion of orange juice. He attributes this caries to a high calcium-low phosphorus ratio. He states that when calcium, which was in the form of calcium carbonate was removed from this diet, monkeys did not develop caries. This was true for four monkeys, but Klein overlooked the fact that another so fed still developed caries, as did three of fourteen on a diet still lower in calcium.

Klein has had about 700 rats under his observation, and has been able to produce caries in these animals in accordance with his phosphorus theory. It is interesting to note that the male rats, except those on his most severe diets, developed little or no caries. The major portion of the caries production occurred in female rats producing from four to five litters of young a year.

At the same time that Klein presented his paper, W. H. Eddy, another nutritionist, read a paper before another section. Eddy stated that while he was aware that Klein was presenting a paper stressing the importance of phosphorus in the diet, he, Eddy, was of the opinion that we are quite likely to get an excess of phosphorus in our modern diets. Such an excess should be guarded against because of its tendency to produce acidosis.

Klein's observations open a new approach for diet study.

Time does not permit me to more than mention the work of Martha Jones[22] and J. A. Marshall.[23] Martha Jones has made a careful and detailed study of the so-called odontoclasia and dental caries which occurs in children living in Hawaii. She concludes from her studies that decay of the teeth appears to be directly related to metabolism, which has many factors, including diet. Her idea is that any factor or combination of factors in the decrease of the amount of base in

21. McCollum, E. V., et al.: Bull. Johns Hopkins Hosp., 33:202-215 (June 22) 1922.

22. Jones, Martha; Larsen, N. P., and Prichard, G. P.: (*a*) D. Cosmos, 72:439-450 (May); (*b*) 574-577 (June); (*c*) 685-699 (July), (*d*) 797-810 (Aug.) 1930.

23. Marshall, J. S.: Dental Caries and Pulp Sequelae Resulting from Experimental Diets, J. A. D. A., 14:3-37 (Jan.) 1927; Control of Dental Caries by Means of Diet, ibid., 15: 295-304 (Feb.) 1928.

the tissue fluids, especially in blood and saliva, will proportionately increase the liability of enamel to decay. Toverud, in a very recent publication, criticizes the work of Jones because no blood or salivary studies were made to prove this contention.[24]

Marshall concludes, from his study of caries, that metabolism and nutrition have an effect on oral health, probably through the saliva. He conducted dietary experiments on rats and found caries produced by a vitamin A deficiency. These rats showed marked symptoms of avitaminosis. It is my opinion that it should not be necessary to induce caries by producing undernourishment and malformation in animals, as many investigators have done. Such conditions are not necessarily present in human beings having this disease.

The view that bacteria are of prime importance in the development of dental caries is still held by some, notably, Russell W. Bunting and the Michigan group.[25] They "are convinced that dental caries is in reality an infective disease and that the specific organism involved is *Bacillus acidophilus*." Bunting and his co-workers have conducted experiments on an extensive scale in the attempt to prove their contention. Their work was instigated by the observations of McIntosh, James and Barlow,[26] of England, and Rodriguez,[27] of the United States Army, who found *Bacillus acidophilus* present in carious material, often in pure culture. This material was cultered in acid sugar broth on the assumption that if caries resulted from acid produced by bacteria, these bacteria must be capable of living in an acid environment.

The Michigan group has now studied bacteriologically several thousand mouths. They have found a definite correlation between the presence of this organism and susceptibility to caries. An absence of the organism was usually associated with immunity. If the organism was found present and the teeth were apparently immune, the patient, on examination after six months or more, would usually show the beginning of active caries. To them, this indicates that the organism precedes the lesion.

They reasoned that if caries were the result of a specific infection, Koch's postulates could be conformed to. They have been unsuccessful in this attempt. They cultered the organism from the affected area, conforming to the first postulate, and they grew it over several generations on artificial mediums, complying with the second, but they could not produce the lesion by the application of this organism to teeth, either *in vitro* or *in vivo*. Their attempts to produce caries in the mouth by applying cultures of acidophilus under clasps fitted to the teeth are most interesting. Decalcification was produced in a relatively short time, but this lesion did not resemble typical caries. From this lesion, they were again able

24. Toverud, K. U., and Toverud, G.: Acta Paediat. (Supp. 2), 12:107, 1931.

25. Bunting, R. W., and Palmerlee, Faith: (*a*) Rôle of Bacillus Acidophilus in Dental Caries, J. A. D. A., 12:381-413 (April) 1925. (*b*) Bunting, R. W., Nickerson, Gail, and Hard, Dorothy G.: D. Cosmos, 68:931-942 (Oct.) 1926. (*c*) Bunting, R. W., et al.: 70: 1-8 (Jan.), (*d*) 1002-1009 (Oct.) 1928. (*e*) Proc. Soc. Exper. Biol. & Med., 27:426-427, 1929-1930. (*f*) Bunting, R. W.: D. Cosmos, 72:399-407 (April) 1930. (*g*) Hadley, Faith P.; Bunting, R. W., and Delves, Edna A.: Recognition of Bacillus Acidophilus Associated with Dental Caries: Preliminary Report, J. A. D. A., 17:2041-2058 (Nov.) 1930; (*h*) Hadley, Faith P., and Bunting, R. W.: Further Studies on Recognition of B. Acidophilus, ibid., 19:28-36 (Jan.) 1932.

26. McIntosh, James; James, W. W., and Lazarus-Barlow, Peter: Brit. D. J., 43:728-739 (Aug. 1) 1922.

27. Rodriguez, F. E.: Mil. D. J., 5:199, 1922.

to culture acidophilus, complying with Koch's fourth postulate.

They have given study to the absence of *B. acidophilus* in immune mouths and have attempted to inoculate the organism into those mouths. This was done by feeding daily from a glass to a quart of a milk culture of oral acidophilus. The mouths were cultured every day for one week, just before the milk was drunk. Most of the children in this experiment remained negative, and all of the adults gave negative cultures each day. Although the organisms were implanted in large quantities, they quickly disappeared.

They have been attempting by various means to control dental caries through the elimination of *B. acidophilus* from the oral flora. Bunting must be given credit for being an investigator who has the ability to change his mind in accordance with his experimental findings. In 1925, he was of the opinion that overgrowths of acidophilus and perhaps dental caries could be controlled by the use of anilin dyes as antiseptics.[28] In 1926, he was using metaphen.[29] In 1928, hexylresorcinol combined with a metaphen prophylaxis was advocated.[30] In 1930, as a result of some interesting dietary experiments conducted in orphanages, he was of the opinion that a well-balanced diet containing a minimum amount of sugar and pastries exerted the greatest inhibitive force.[31] Hexylresorcinol mouth washes were used in conjunction with the dietary treatment, but other experiments have led him to believe that diet has the greatest influence.

Recently, Hadley and Bunting have published an article on the recognition of *Bacillus acidophilus*.[32] These studies show that the acidophilus organism has a higher incidence in immune mouths than was heretofore reported. They explain this difference in two ways. More recent studies of this organism have shown it to be highly pleomorphic,[33] and, in their early investigations, atypical forms of acidophilus were perhaps not recorded as positive. In the present study, more than one examination was made of the immune mouths. They also suggest the possiblity of a quantitative difference which they did not determine; that is, the organism might be present in immune mouths but not in so great numbers as in the susceptible ones.

Bunting believes that caries is governed by constitutional conditions which produce a proper environment in the mouth. He believes that "diet influences dental caries most directly through its effect on the bacterial flora of the mouth."

A Japanese, M. Shibata, has published the results of an experiment which he asserts substantiates Miller's theory of dental caries.[34] He used a group of young rats and fed them a diet of rice and greens which was mixed with 5-10 per cent of various sugars. The animals were killed after from twenty to fifty days on such a diet. He states that he always found necrotic cavities with the enamel destroyed. In some instances, the crowns were destroyed in a week's time. According to Shibata, the more adhesive sugars, such as dextrose, maltose and sucrose, required a shorter time for caries production than did glucose and lactose. These diets would not induce caries in the adult rat. This Shibata believes to be due to the abraded condition of the adult molars. It is his conclusion that the adhesive

28. Footnote 25, first reference (*a*).
29. Footnote 25, second reference (*b*).
30. Footnote 25, fourth reference (*d*).
31. Footnote 25, fifth and sixth references (*e* and *f*).
32. Footnote 25, eighth reference (*h*).
33. Footnote 25, seventh reference (*g*).
34. Shibata, M.: Jap. J. Exper. Med., 7:247 (April 10) 1929.

sugars lodge in the deep sulci of the young molars, that they are fermented by *Bacillus acidophilus* and that the acids of fermentation destroy the crown.

I have repeated Shibata's experiment, not once but on four different groups of animals. The results will be published in detail. I have fed these diets to young rats not from twenty to fifty days but to some for more than sixty days. They were markedly undernourished and weighed less at the conclusion of the experiment than at the beginning. *Bacillus acidophilus* was quite regularly found in their mouths; but not one rat developed one decayed molar. As Klein points out, caries can hardly be expected in the rat before 100 days of feeding.[35]

Evidence is accumulating that a well-balanced diet in some manner improves dental as well as general health. We should keep in mind that in balancing these diets, the intake of sugar and other refined carbohydrates has been generally reduced. It might be argued that conditions were improved by this reduction as well as by the increase in vitamins and mineral elements. Howitt,[36] Kligler,[37] Bunting[28] and others have shown that the presence of sugar in the diet and in the culture medium enhances the development of aciduric bacteria. Lombard cites some interesting statistics obtained from the *Sugar Beet Journal*.[38] The consumption of sugar by American people increased from 10 pounds a person in 1823 to 104 pounds a person in 1923. Also remember that in Hawaii where the abundant sunlight furnishes sufficient vitamin D to make rickets a rare disease,[39] caries is common, and that in the far north where fresh fruits and vegetables, as we think of them, do not exist, caries is uncommon unless contact has been made with civilized diet.

From a review of the past experiments and observations, what do we actually know about this disease, dental caries? We possess these facts:

1. Primitive people both ancient and modern, living in their native environment, developed little decay.
2. With the advancement of civilization, with the refinement of food and living conditions, dental caries has markedly increased.
3. Caries is, as a rule, most active during childhood and adolescence; that is, during the growth period.
4. Metabolic disturbances produced by such conditions as pregnancy and diabetes seem to increase susceptibility to caries.
5. The disease has never been produced outside the oral environment.
6. It stops with the extraction of the tooth and ceases with the death of the individual. Teeth and skeleton are not subject to proteolytic decomposition as is the rest of the body.
7. The crowns of extracted teeth mounted on artificial dentures and worn in susceptible mouths sometimes develop caries.[40]
8. Caries is confined largely to so-called areas of susceptibility. These are more or less protected areas, where there is opportunity for stagnation and the collection of foreign material. The more exposed areas, such as prominent angles and cusps, are immune.

35. Klein, Henry, and McCollum, E. V.: J. D. Res., 11:745-746 (Oct.) 1931.

36. Howitt, Beatrice F., and Fleming, W. C.: J. D. Res., 8:435-437 (June) 1928.

37. Kligler, I. J.: J. Allied D. Soc., 10:282-330, 1915.

38. Lombard, Lou: Spare the Sweets and Save the Teeth, J. A. D. A., 11:1246 (Dec.) 1924.

39. Footnote 22, third reference (*c*).

40. Black G. V.: Formation of Poisons by Microorganisms, Philadelphia: P. Blakiston & Son, 1884; p. 149.

9. Caries does not begin or extend under healthy gum tissue.

10. Aciduric and acidogenic bacteria can be found in the active carious cavity.

11. These organisms can be cultured from the saliva of the susceptible individual, yet not all susceptible areas in the mouth become carious although exposed to the same bacteria. Of two approximating teeth, one may be destroyed by the carious process and the other not even be affected.

12. The caries lesion, although developing in a susceptible area, may become arrested and remain so indefinitely.

What is the basis for the foregoing facts? In the light of our present knowledge, we do not know. The investigators can only speculate, and no theory yet advanced has enough evidence to answer all the above named phenomena. They will continue to speculate until they know more concerning the specific etiology of this disease. The nutritionists, especially, are practicing empiricism, for they are, it appears, attempting to cure a condition without knowing its exact cause. This is perhaps the reason for the variety of opinions as to just what the important dietary elements are. They state that the lack of this or excess of that in the diet results in caries, but they cannot say "how." I do not mean that nutritional investigation is unimportant, but I do believe that the histologist, the bacteriologist, the chemist and the clinician should cencentrate on the answer to that "how." When we know that answer, we can proceed to the answer for the "why" in a much more rational manner.

DISCUSSION

Frederick B. Noyes, Chicago, Ill.: It is only Dr. Kesel's last paragraph that I would emphasize—the importance of the coordination of the work of a considerable group in this study. I felt as he read that in the past this had been the greatest source of error, the lack of coordinating the results of different methods of attack; and the last factor that he mentioned has been in the last few years most conspicuously omitted. That is the work of the clinician. The question of dental caries cannot be solved by experimental methods alone. Solution must be sought by the coordination of experimental methods with clinical observations. The great value of G. V. Black's studies of caries lay in the fact that, during all of the period that he was intensively studying caries in the laboratory, he was also studying caries in the mouth as a clinician.

Austin F. James, Chicago, Ill.: I am associated with the group of dentists who have been working with Dr. Hanke on the problem of the relation of nutrition to dental health. Dr. Hanke makes no claims as to the control of dental caries, but many interesting facts have developed indicating that deficient nutrition has its influence on the occurrence of dental caries. We are very sure that nutritional disturbance has much to do with pulpal and many gingival conditions. We find that adding certain elements to the diet causes a marked improvement in conditions and results are more easily maintained in all cases where the supporting structure of the teeth has been affected. My grief has been that we know of no laboratory test that can be used to confirm our clinical findings. We do know that our cases are showing better results than before this study was undertaken.

C. N. Johnson, Chicago, Ill.: I have been impressed with what Dr. Noyes has said in connection with the necessity for combining clinical experience with laboratory study. I have never had the privilege of making laboratory studies, but I have practiced dentistry a long time; I have seen a great many mouths; I have tried to be observant of the manifestations in those mouths, and I want to confess that, in reading the dental literature, I have too frequently been confronted with the fact that my clinical demonstrations and findings did not tally with the results of the laboratory tests. And I want to reiterate what has already been said, that, in the ultimate, while laboratory experimentation is of immense value, the thing that really counts is our clinical experience.

UTILIZATION OF RADIOPAQUE SOLUTIONS IN DETERMINING FINAL INTERPRETATIONS OF ORAL LESIONS*

By LE ROY M. ENNIS, D.D.S., Philadelphia, Pa.

THE invaluable boon brought to suffering humanity through the discoveries of Prof. William Konrad Roentgen forms the greatest single contribution to dental therapeutics. Numerous and enormous as our errors proved prior to the development of a finer and more assured technic in the application of the roentgen rays, we may well marvel that the errors were so few, relatively; for by the penetrating light of modern discovery, we have discerned, for the first time, the depth of the darkness through which the dentist groped in his endeavors. Diagnosis and prognosis, risked at a guess and with a hope then, are now made with almost certain knowledge of conditions; for today we can eliminate random explorations based mainly on conjecture or the reported sensations of the patient, relying, as we do, on the conclusions that the well taken and properly interpreted roentgenograms permit.

The function of the roentgenologist in the diagnosis of oral lesions cannot be overemphasized. Not only does the roentgenographic examination confirm the clinical determination as to the existing lesions and other pathologic symptoms, but also, after surgical or general treatment, the roentgenogram offers a dependable check-up.

Dependence on the diagnostic wire in root-canal therapy has always presented objectionable features. No matter how careful the operator, there is always the danger that the wire passing through the apical foramen will penetrate the structures in the apical region, and introduce infection.

The true and actual size of the root canal under treatment, its shape and its angle, may not be realized completely by the use of the wire. This must be conceded, the great number of troublesome conditions arising consequent to treatment affording indisputable proof. To see wires hopelessly embedded in the cavity, beyond the possibility of removal except by delicate surgery, is not unusual. (Fig. 1.)

Many cases of extraction and root amputation are attributable to this occurrence. But however remote the possibility of complication may seem, the dentist does not close his eyes to or risk any distant danger that may be avoided. It is for that reason that we remove the diagnostic wire promptly after completing the test; for, since it is sealed with the soft and malleable material employed in the operation, undue pressure and pounding on it must be prevented to avoid dire results. (Fig. 2.)

Not infrequently, the diagnostic wire passes far beyond the apical region of the tooth under treatment. (Fig. 3.)

*From the Department of Roentgenology, Dental School of the University of Pennsylvania.

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 21, 1931.

Quite often, the absence of sensation on the part of the patient when this does occur, surprising in itself, leads to danger; for, in many cases, the root-canal filling material is so inserted in the canal as to be forced beyond the apical region of the tooth, thus, sometimes, setting up an inflammatory reaction which so often spells the ultimate loss of the tooth before necessary. (Figs. 4-5.)

Instead of using the diagnostic metallic wire as the agent whereby the roentgen rays are employed to determine the length and configuration of the root canal and to ascertain whether access to the

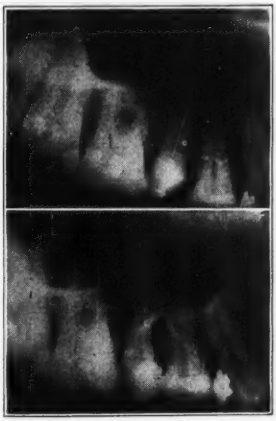


Fig. 1.—Diagnostic wires passing through apex of second bicuspid.

apical foramen has been attained, lipiodol may be used with superior results.

While the use of iodized oils is not uncommon among members of the medical profession, and particularly since 1926, when Goodyear reported a study of thirty-five cases in which he injected lipiodol into the maxillary sinuses for the purpose of making roentgenographic examinations as an aid to diagnosis, up to the present time, there has been no report of their employment by the dental roentgenologist or in the field of general dentistry.

Though other iodized oils may answer the purposes of the roentgenologist, the experience of the general roentgenologist with lipiodol recommends it as a non-irritant sterilized radiopaque fluid which may be injected into the sinuses and fistulous tracts without causing pain; and, as it is readily absorbed by the tissues, it may be allowed to remain in the injected area indefinitely. Lipiodol is an iodized vegetable oil, the product of the combination of red-poppy seed oil with pure metalloid iodin, without any trace of chlorin.

Fig. 2.—Diagnostic wire passing through perforation but lost; result of allowing diagnostic wire to remain in tooth under temporary filling.

The combination is such that iodin can be identified only by dissociation of the product. The vegetable oil with "dissembled metalloid" behaves as a fat when introduced into the body, where it is nontoxic.

There are two uses to which iodized oils may be put in dentistry: to supplement the diagnostic wire now used, and to localize the seat of infection that causes fistulous tracts associated with the oral cavity.

The technic for the insertion of lipiodol into a root canal is extremely easy. After the tooth has been opened to afford accessibility to the root canals, and the canals have been cleaned and opened, an excess of lipiodol is placed in the pulp chamber. A paper-point is saturated with the iodized oil, carried to the canal, and inserted with a slow pumping movement, being worked into the canal as far as it would be possible to place a root-canal filling. It may be necessary to use more than one paper-point, for in being worked back and forth, the paper point may become distorted. If an excess of lipiodol passes through the foramen, it does not matter, as it is readily absorbed by the tissues, and is nonirritating.

Fig. 3.—Donaldson broach used as diagnostic wire passing through apical foramen of maxillary cuspid far into cancellated bone, patient suffering no pain.

Fig. 4.—Root-canal filling passing through apex of lingual root of first molar, extending into maxillary sinus.

As time is a factor in the treatment of root canals, lipiodol may be diluted with camphomonochloraphenol; but as the radiopacity of lipiodol becomes reduced by dilution, care must be exercised to add just the proper proportions, which have been found to be lipiodol, 16 parts, camphomonochloraphenol, 1 part. The addition of the latter adds a germicidal quality to the solution, as well as affording radiopacity. (Figs. 6-7.)

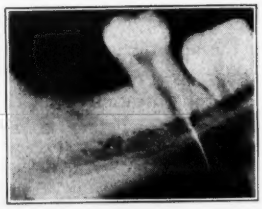


Fig. 5.—Root-canal filling extending through apical foramen, down to lower border of mandible.

Fig. 6.—Lipiodol on paper point showing no bacterial action.

With the diluted lipiodol, the same technic may be used. The paper point, saturated with the solution, in this case may be sealed in the canal with gutta-

percha and the roentgenogram made, and the patient may be dismissed without the necessity of opening the canal. Thus, the operator not only will be given the exact configuration of the root canal, but will also know exactly where the filling will penetrate when inserted. (Fig. 8.)

Furthermore, when the patient returns for the succeeding treatment, the seal is removed, the point withdrawn, a dry point inserted to absorb any excess lipiodol remaining, and, once clear, the canal is ready for further treatment or filling.

For the localization of perforated roots, iodized oils are ideal. In such cases, the undiluted oil is pumped into the root canal in the same manner as in preparing a root canal for filling. It is necessary at times, especially where there is a fistula established in connection with the perforation, to force the pure, undiluted lipiodol into the canal by means of a Luer syringe. Lipiodol is placed in the syringe, a small piece of unvulcanized rubber is placed around the needle and the needle then inserted in the canal as far as possible. The unvulcanized rubber is then packed in the cavity of the tooth. The lipiodol is now slowly injected, pressure being exerted until the oil comes through the fistula. The roentgenogram is then made, showing the size and direction of the perforation. (Fig. 9.)

The examination of fistulous tracts to ascertain the seat of foci of infection demands a slight deviation from the technic used in the investigation of root canals. Here, it is necessary to inject the oil into the fistulous tract. This is best done by using a Luer or Record syringe, with a 2-inch needle having a blunt nose and of about 21 gage. If the seat of infection is deep and the fistula large, a small gage rubber tube may be used instead of the needle. (Fig. 10.) In either case, the technic of injection is the same. The syringe is filled with lipiodol and the needle or rubber tube is passed through the fistula and into the fistulous tract until it meets resistance. The syringe is now attached to the needle or tubing. The oil is thereupon slowly in-

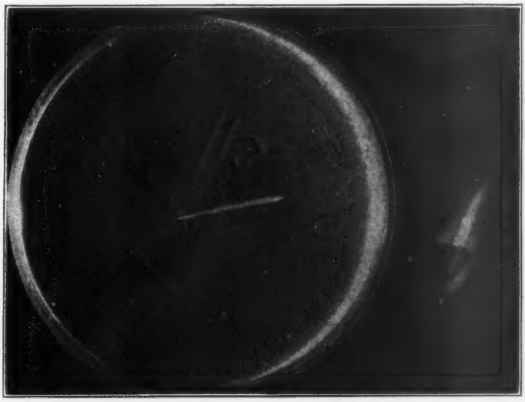


Fig. 7.—Left, lipiodol diluted with camphomonochlorphenol showing bactericidal action; right, lipiodol showing radiopaque area in root canal.

jected and the needle or tubing is slowly withdrawn during the injection, so that the fistulous tract may be filled. After complete withdrawal of the needle, the fistula is immediately closed with a cotton or gauze plug to prevent the oil escaping from the tract.

A roentgenogram is then made, the lipiodol appearing as a radiopaque area outlining the tract and leading to the source of infection. (Fig. 15.)

Fig. 8.—Diluted lipiodol in root canal showing configuration of canal.

This technic applies not only to fistulas within the oral cavity, but also to those which follow some grosser lesion of the jaw.

The operator need not worry about removing lipiodol after injecting it into the fistulous tracts, for it is readily absorbed and nonirritant. It is merely a question of hours.

Caution should dictate to the operator that the syringe and needle should never be used without having been thoroughly sterilized by boiling. Especially with the needle, this should never be neglected. It must be boiled: it must not be flamed; for the combustion of the oil constituent in lipiodol leaves minute particles of carbon in the lumen of the needle, and, at the same time, the iodin thus liberated attacks the metal.

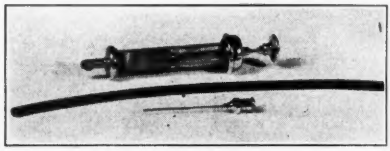


Fig. 10.—Record syringe, blunt needle and rubber tubing used for injection of lipiodol.

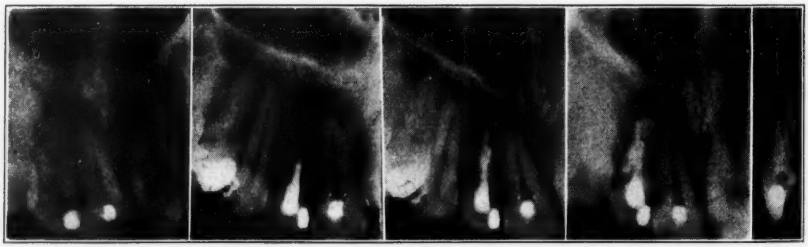


Fig. 9.—Left to right: maxillary second incisor which had fistula established; lipiodol extending to middle third of root; lipiodol after injection showing enlargement at middle third of canal; another view of case showing lipiodol passing out to side of root; tooth after extraction, with lipiodol in canal showing perforation.

When the maxillary sinuses are to be examined, the iodized oil may be injected into the sinuses through a 16-gage steel cannula, filling the sinus through the middle meatus of the nose. The oil is diluted 50 per cent with heavy liquid

petrolatum, which offers a viscosity that is an advantage, as it is slow in leaving the sinus, thus permitting filling even above the normal ostium. Dry cotton is immediately packed in the middle meatuses to prevent overflow into the nose. This is the technic of Henry Goodyear, of Cincinnati, which has proved highly successful.

In sinuses previously opened, a thin strip of gauze soaked in full strength iodized oil may be inserted before the roentgenographic examination, and likewise, in the examination of fistulous tracts in chronic cases of osteomyelitis, a strip of gauze saturated with iodized oil can be passed along the tract by means of a probe before the roentgenographic examination.

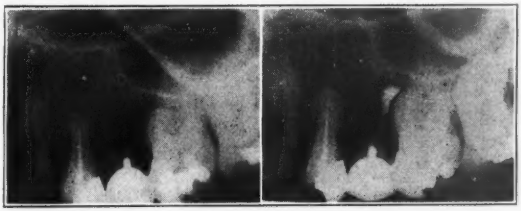


Fig. 11.—Case in which fistula appeared in region of second bicuspid one month after restoration of tooth. Left: Film showing slight absorption of bone and remains of second bicuspid socket. Right: Radiopaque oil in tract leading to mesial buccal root of first molar.

Fig. 12.—Fistula established in first molar region after extraction. The second molar responded to a vitality test. The lipiodol injected into the fistulous tract passed to the apex of the second molar.

CONCLUSION

1. The use of opaque or iodized oils is an additional and a very important step beyond employment of the simple roentgenogram.

2. Iodized oils may be used in canals, sinuses and fistulas as routine, with little additional effort, whenever roentgenograms are indicated.

3. The use of iodized oils in root canals gives the actual size and configuration of the canal.

4. Sinuses previously opened may be studied by packing with a thin strip of gauze soaked in full strength iodized poppy seed oil before roentgenographic examination.

5. Fistulous tracts, the result of osteomyelitis, may be studied by the insertion of a strip of gauze soaked in full strength iodized oil.

6. For direct instillation into root canals, camphomonochloraphenol is added to give the oil a bactericidal action.

REPORT OF CASES

CASE 1.—Mrs. J. W., aged 30, had a maxillary right second bicuspid extracted and a bridge immediately placed in position. About one month after restoration, a fistula appeared in the region of the second bicuspid. Roentgenograms were made and the patient's dentist believed that the infection was coming from the socket of the extracted tooth. He probed and treated the area, but the fistula was persistent. After seven months had passed, the patient was sent for examination. A roentgenogram of the region revealed nothing except a slight absorption of bone and remains of the second bicuspid socket. Lipiodol was then injected into the fistulous tract, and a roentgenogram made, which showed

Fig. 13.—Case shown in Figure 12; occlusal film confirming interpretation.

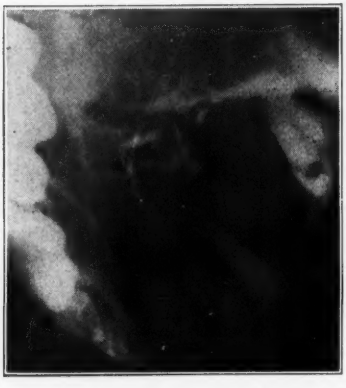


Fig. 14.—Infected cyst of maxilla injected with radiopaque oil.

Fig. 15.—Fistulous tract injected with radiopaque oil, fistula being posterior to angle of mandible. The oil is seen in the tract leading to the anterior part of the mouth.

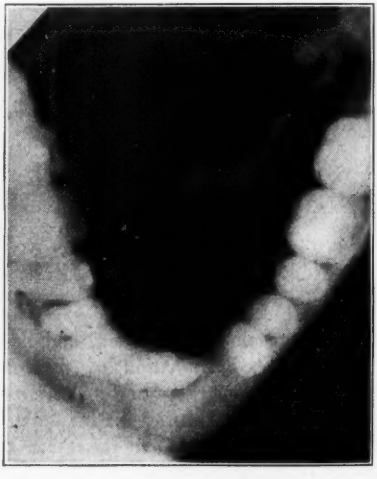


Fig. 16.—Case shown in Figure 15; occlusal film of floor of mouth showing radiopaque oil in fistulous tract leading to symphysis, and sequestration of large piece of bone resulting from fracture at symphysis of mandible.

the radiopaque oil in the tract leading to the mesial buccal root of the first molar. An incision was made and the periosteum of the mesial root of the molar was found highly inflamed. This was curetted; the condition cleared up, and there has been no recurrence. (Fig. 11.)

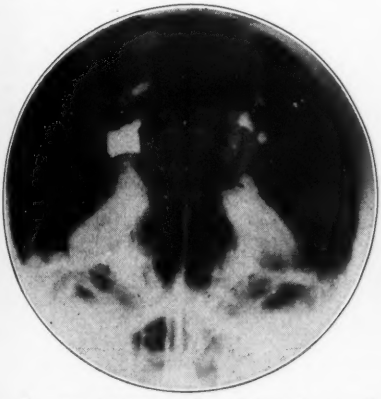


Fig. 17.—Lipiodol injected into the maxillary sinuses showing normal sinuses, and relationship to maxillary teeth.

Fig. 18.—Lipiodol in infected sinus showing sinus to be incompletely filled and therefore that something exists between lipiodol and walls of sinus.

Case 2.—Mrs. J. C., aged 48, had a maxillary first molar extracted in September, 1929. In November, 1929, a fistula was established in the first molar region lingually. The patient, who was in constant fear of malignancy, had roentgenograms made. These were interpreted as negative. The patient was then under medical attention, but the cause of the fistula could not be ascertained. In April, 1931, she was sent in for diagnosis. Lipiodol was injected into the fistulous tract. Roentgenograms showed the ra-

Fig. 19.—Maxillary sinus incompletely filled with lipiodol.

Fig. 20.—Case shown in Figure 19, with patient in reclining position; lipiodol flowing to posterior portion of sinus, showing a decided thickening of lining of sinus.

diopaque oil leading to the lingual root of the second molar, which was in turn extracted. The fistula immediately disappeared without further treatment. (Figs. 12-13.)

CASE 3.—Mr. H. M., aged 35, presented a large fistula in the maxillary bicuspid region. Lipiodol was injected, and a roentgenogram showed lipiodol scattered throughout the area. On operation, the area was found to contain an infected cyst. (Fig. 14.)

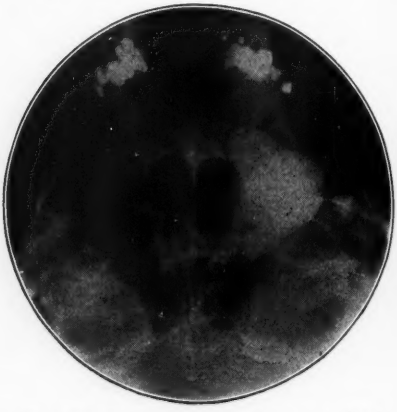


Fig. 21.—Left maxillary sinus completely filled with lipiodol; variation in density at lower border of sinus.

Fig. 22.—Occipital view of case shown in Figure 21, showing septum in anterior wall of sinus causing variation in density.

CASE 4.—Mr. T. C., aged 28, whose history showed a 4 plus Wassermann reaction, had a fracture of the mandible in the region of the symphysis. In October, 1930, the patient was treated and discharged from the hospital. In May, 1931, a large fistula was established on the outside of the face, posterior to the submaxillary region. Lipiodol was injected into the fistulous tract, and a lateral plate of the head made. Radiopaque oil was

Fig. 23.—Maxillary sinus completely filled except at superior border of sinus.

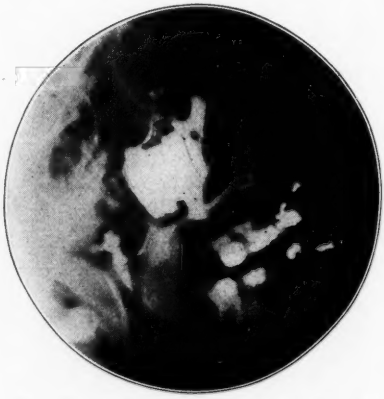


Fig. 24.—Case shown in Figure 23, with patient in reclining position; showing thickening of lining along posterior border of sinus and superior portion of sinus filled with polypus.

revealed, passing forward toward the symphysis. An occlusal film then showed the oil passing forward to a large piece of sequestered bone, posterior to the symphysis. (Figs. 15-16.)

DISCUSSION

George F. Seeman, Nashville, Tenn.: The proper interpretation of oral lesions is an important question confronting our profession. Many members of our profession have purchased x-ray machines and have been shown how to throw the switch and that is all. The public is beginning to wonder whether there is really anything to be gained by roentgen-ray examination because of the uncertainty of the interpretation. There are many factors which enter into this subject—history, clinical findings and the results of the various specialized methods of examination. The x-ray never lies. It is very easy at times to read something that is not present or miss something which is present. Interpretation is the determination of the histologic, anatomic and pathologic condition present in any given area, and this requires more than roentgen rays. As to the use of radiopaque solutions in the interpretation of lesions: The only ones I have had any experience with are lipiodol and bismuth paste. I have found the former very valuable in sinus work as the filling defect shows almost conclusively the presence of granulomatous tissue. I have noted a very valuable therapeutic effect from lipiodol. I have also used lipiodol in the lower molar sockets to outline clearly the empty socket; which is helpful in locating residual root ends. I would advise everyone to try these radiopaque solutions in connection with their roentgen-ray work as it will, I believe, prove very helpful.

A. T. Rasmussen, LaCrosse, Wis.: The use of lipiodol has taken the place, to some extent, of exploratory operations in cases that by ordinary roentgenographic methods look suspicious. Especially is this true in the case of pathologic conditions of the maxillary sinus. Many cases of chronic maxillary sinusitis have gone undiagnosed for years for lack of some definite symptom. I have not hesitated, and do not now hesitate, to make exploratory operations on the sinus when necessary to satisfy myself as to conditions. This I have done many times, and I can see no reason that it should not be done here as in other parts of the body. There is no great danger in opening into the maxillary sinus, passing a suitable light into it and making a careful examination. The lining membrane of the sinus does not become infected from such an operation properly done, and outside the inconvenience to the patient, and, of course, the element of danger that is always present in any operation or administration of anesthetics, the patient will suffer no bad consequences. But how much better to use a radiopaque solution such as Dr. Ennis has described, and of which lipiodol is one, and avoid operating when possible. I believe in doing the least radical thing that will accomplish the result, and I place no little value on the use of radiopaque solutions in the maxillary sinus in such cases as it seems to be indicated. These radiopaque oils are also very fine for injection into sinuses or fistulas in order to show where they may lead. In periapical infections with discharging sinuses or fistulas, they can be used by being forced through the canal as mentioned before, or in some cases where there is a discharge on the gum or the palate, the oil may be injected into the tract by the use of a flexible needle, following the tract as far as possible. Frequently, the oil can be forced farther in the tract and show just where it leads. I have not tried it in closed periapical abscesses, fearing untoward results from the pressure and inability of the oil to escape. I can see that it would be of value in determining the outlines of bone destruction, if it can be got in without undue pressure. I believe radiopaque fluids have a distinct and important place in diagnostic examinations.

PERIODONTAL DIAGNOSIS AND THE ROENTGEN RAYS*

By HENRY CLINE FIXOTT, D.M.D., F.A.C.D., Portland, Ore.

A CONSIDERATION of the value of the use of the roentgen rays in any special department of dental practice would not be complete without some knowledge of its value in general dentistry. I will therefore preface my remarks on periodontal diagnosis and the roentgen rays by a brief discussion of the value of the roentgen rays in the broader field of general dental diagnosis.

Anything I may say will appear to be a restatement of accepted facts. That is true in part only. I shall restate facts that have been presented many times to the dental and medical professions, but my experience has been that these facts are not generally accepted.[1]

For the purpose of convenience, I shall discuss the subject under the following headings: (1) the attitude of the profession on the value of the roentgen rays in dentistry; (2) the roentgen rays—an asset or a liability in dental practice; (3) a brief summary of a series of studies of 1,000 cases that were presented for complete roentgenographic examination and diagnosis in my practice, and (4) periodontal disease as revealed in the roentgenogram.

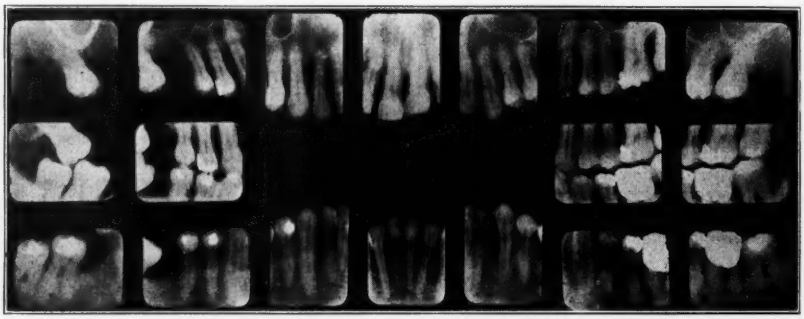


Fig. 1.—Roentgenographic study of case of periodontoclasia. There are deep pockets and an alveolar recession due to premature loss of teeth. A combination of regular and bitewing technic adds to the value of the examination.

*Read before the Section on Periodontia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 21, 1931.

1. Fixott, H. C.: Some Facts Concerning Oral Diagnosis and Lack of Cooperation Between Medical and Dental Professions, Northwest J. Dent., 13:8 (June) 1925.

THE ATTITUDE OF THE PROFESSION

Some authorities say, "Roentgenographic examination should be insisted on in every case of doubtful diagnosis." I thoroughly agree with that statement, but would add that there will always be a doubt as to oral conditions until a complete roentgenographic examination has been made.

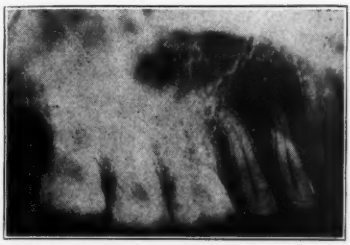


Fig. 2.—Roentgenographic appearance of normal periodontal tissues.

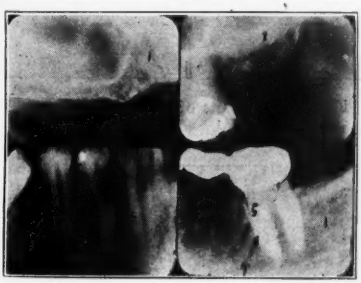


Fig. 3.—Important tissues to be considered in interpretation of dental roentgenograms: *1*, alveolar process, *2*, alveolar crest, *3*, lamina dura, *4*, peridental membrane, *5*, cementum and dentin, *6*, enamel and 7, pulp.

Others have said, "The roentgenogram is not always a truthful portrayal of conditions." It would be more nearly correct to say that the dental roentgenogram does not always tell the whole truth. The roentgenogram is an exact representation of tissue densities at a given angle. Knowledge of technic and ability to interpret a roentgenogram will always reveal the truth as far as it can be revealed within a necessarily limited sphere. The story told in the roentgenogram must be correlated with clinical history, physical examination, etc., before diagnosis is complete.[2]

Mead says[3]:

> Full mouth radiograms are advisable in all cases. No matter how careful the operator, there are times when he will be mistaken without radiograms of all of the teeth. There is every advantage in full set cases, for they serve as a record, relieve the operator of any uncertainty, and ultimately save time.

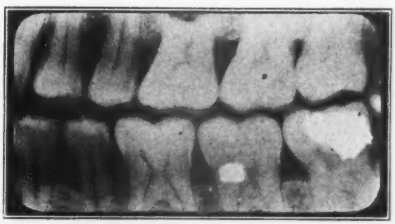


Fig. 4.—Roentgenographic study showing beginning of alveolar resorption.

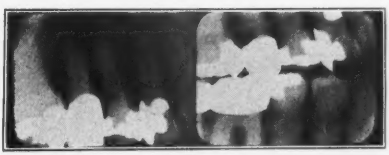


Fig. 5.—Caries under crown distal to second bicuspid shown in bitewing but not in ordinary film; illustrating advantage of using combination of ordinary and bitewing films.

Many dentists and physicians agree that the use of the roentgen rays in dentistry is extremely valuable, yet in making an examination, they roentgenograph a crown here, a pulpless tooth there, and

2. Fixott, H. C.: Thorough Oral Diagnosis, Northwest J. Dent., 13:17 (July) 1925.

3. Mead, S. V.: Diseases of the Mouth, St. Louis: C. V. Mosby Co., pp. 47, 51.

think they know conditions. Why straddle the question? If you do not believe in the value of the roentgen rays in dental diagnosis, do not use them. If you believe them to be a valuable aid, use them systematically, regularly and intelligently.

It appears to me that the first consideration of the dentist should be the general well-being of the patient. He should

Fig. 6.—Rough filling mesial to upper second molar shown in ordinary film, but not in bitewing.

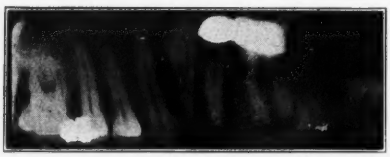


Fig. 7.—Destruction of process involving bifurcation of roots.

ask himself the question: How shall I care for this patient so as to cure or relieve the present condition, protect the patient's health and prevent, as far as in my power, future trouble?

I believe the answer to that question is through conscientious diagnosis and intelligent cooperation with the medical profession.[1]

ROENTGEN RAYS AN ASSET OR A LIABILITY

As an Asset.—Most of you will agree with me when I say that the roentgen rays are an indispensable asset as an aid to diagnosis, but I ask you in all seriousness, have you made it indispensable in your practice? The roentgen rays are an asset to a dental practice only when used intelligently. Intelligent use of the roentgen rays requires a technical skill

Fig. 8.—Deposits of calculus and tissue recession.

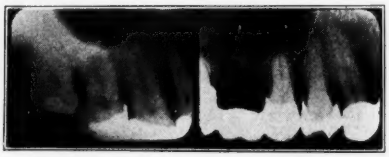


Fig. 9.—Rough fillings as revealed in roentgenogram.

that produces readable diagnostic roentgenograms of the area to be studied, plus the experience and ability to interpret the message pictured in the negative.

As a Liability.—The roentgen rays are a liability when one attempts to interpret improperly exposed, developed and mounted roentgenograms, having little or no experience or training that would

enable him to recognize in the roentgenogram normal tissue and tissue changes produced by pathologic processes, etc.; or when dentist or physician depends on technicians for interpretation and advice.

Again quoting Mead[3]:

The radiogram, therefore, is valuable in oral diagnosis when interpreted by one thoroughly schooled in dentistry and by one who understands what it really shows and knows its defects and limitations. It is entirely wrong for technicians and others who have no knowledge of dentistry to undertake to interpret these views either for the patient or for dentist, as there may be a misinterpretation of what is shown, or a faulty diagnosis.

It is wrong for technicians and others to undertake to interpret roentgenograms for patients or dentists, but it is a greater wrong for dentist or physician to permit them to do so.

To get the best results from the use of the roentgen rays in dentistry, then, requires dental experience, knowledge and sound judgment, and experience in roentgenology. No attempt should be made to reach a final judgment until this knowledge can be obtained.

SUMMARY OF A SERIES OF STUDIES[4]

Loss of teeth and the presence of caries, oversize crowns, rough fillings, deposits of calculus and impacted teeth are contributing causes of periodontal disease. Experience has proved that more than 25 per cent of these and other conditions favoring infection and unfavorable systemic results are not revealed unless complete roentgenodontic examinations are made of all patients.

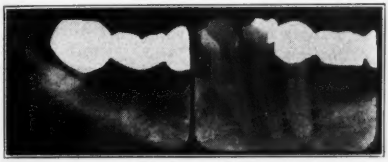


Fig. 10.—Oversized crowns as revealed in roentgenogram.

Fig. 11.—Roentgenographic appearance of caries under fillings and crowns.

Fig. 12.—Loss of pulp in lateral incisor, irregularity of teeth and tissue destruction due to impacted cuspids, as shown in roentgenograms.

Believing that a knowledge of the frequency with which these conditions occur in the mouths of average persons would be of value to the profession, I, with the assistance of my associate, A. F. Weeks, made an exhaustive study and tabulation of the conditions found in

4. Fixott, H. C.: Complete Oral Diagnosis, a Necessary Routine Procedure in Physical Diagnosis, Northwest J. Dent., 18:3 (July) 1930; Bull. California State D. A., September, 1930.

complete roentgenodontic examinations of 1,000 cases. This examination called for not less than fourteen films in any one case, and additional negatives and a bite-wing examination of the molar and bicuspid regions in a majority of cases.

The examination was made of average patients. Not more than 10 per cent represent the underprivileged, ignorant or careless patient, and certainly not more than 10 per cent are representative of the other extreme, the best of care having been taken through life and neither time nor money being an object.

It is believed that this represents a fair cross-section of the conditions found in the mouths of any average group of persons, without reference to age, health, social or financial condition. The findings are presented in the accompanying tables.

TABLE 1.—STATISTICAL STUDIES SHOWING CONDITIONS REVEALED IN COMPLETE ROENTGENODONTIC EXAMINATIONS OF ONE THOUSAND PATIENTS

	No.	Per Cent
Persons examined	1,000	...
With 32 teeth	26	2.6
One or more teeth missing	974	97.4
Having pulpless teeth	772	77.2
With no pulpless teeth	228	22.8
With caries present	903	90.3
With no caries	97	9.7

TABLE 2.—MISSING, PULPLESS AND IMPACTED TEETH (1,000 CASES)

	No.	Per Cent
Possible number of teeth	32,000	...
Teeth present	25,112	80.4
Teeth missing	6,888	19.6
Pulpless teeth	2,437	9.7
Unerupted impacted teeth	276	1.1

TABLE 3.—CONDITION OF PULPLESS TEETH (1,000 CASES)

	No.	Per Cent
Pulpless teeth	2,437	...
No evidence of root filling	365	14.9
Roots partially filled	1,845	75.7
Roots well filled	227	9.4
Periapical tissue change		
Positive	1,911	78.4
Negative	526	21.6
Antrums possibly involved	329	13.4

TABLE 4.—CARIES (1,000 CASES)

	No.	Per Cent
Total number of teeth	25,112	...
Caries present	4,010	15.97
Caries involving pulp*	262	1.04

*Six and five-tenths per cent of all carious areas involve the pulp.

TABLE 5.—INTERPROXIMAL CONDITIONS (EXCLUDING CARIES) (1,000 CASES)

	No.	Per Cent
Teeth present	25,112	...
Oversize rough fillings	775	3.08
Oversize crowns	975	3.90
Bone resorption		
Beginning to coronal one-third of root	9,168	36.50
Beyond coronal one-third of root	3,376	13.40
Total	12,534	49.90

TABLE 6.—IMPACTED TEETH (1,000 CASES)

	No.	Per Cent
Possible number third molars	4,000	...
Impacted	247	6.2
Possible number upper cuspids	2,000	...
Impacted	25	1.2
Other impacted teeth	4	...
Total number of impacted teeth	276	...

TABLE 7.—RESIDUAL AREAS OF INFECTION

	No.	Per Cent
Cases examined	1,000	...
Showing pieces of roots	185	18.5
Showing foreign bodies	37	3.7
Showing radiolucent areas	53	5.3
Showing radiopaque areas	49	4.9

TABLE 8.—OTHER CONDITIONS NOTED

	No. Cases
Root resorption	72
Cysts	22
Hypercementosis	52
Supernumerary teeth	12

These findings emphasize to a marked degree the results of a similar study made by Frank Mihnos of Portland.

Failure to find approximately the percentage of conditions shown in the foregoing tables would indicate a lack of thoroughness in examination or of experience needed and ability to interpret roentgenograms.

PERIODONTAL DISEASE AS REVEALED IN THE ROENTGENOGRAM

Arthur H. Merritt[5] lists the common periodontal diseases in the following order: gingival recession, gingivitis, Vincent's infection and periodontoclasia.

Fig. 13.—Roentgenographic appearance of retromolar pocket.

Gingival Recession, Gingivitis and Vincent's Infection.—Among the predisposing causes of gingival recession, gingivitis and Vincent's infection, oral sepsis and gingival irritation are prominent. Roentgenographic examination for bone resorption, the presence of oversize crowns, rough fillings, partially erupted teeth and deposits of calculus, etc., is surely indicated here.

Periodontoclasia. — This includes pocket formation, inflammation and infection characterized by deep pockets and great destruction of alveolar tissue about teeth. These conditions are graphically shown in thorough roentgenodontic examinations. (Fig. 1.)

Merritt says:[5]

> If the dentist who has not done so were to make a radiographic survey of a dozen adult patients, who on casual examination appeared to have a healthy mouth, he would probably be surprised at the amount of alveolar absorption which has taken place in many of them with very little visible evidence of disease. . . . As a preliminary to treatment, a complete radiographic examination should be made of all cases, for in no other way can a working knowledge be gained of the extent of bone loss about the involved teeth.

When studying periodontal disease as revealed in the roentgenogram, one must be thoroughly familiar with the roentgenographic apearance of normal periodontal tissue (Fig. 2) and be able to recognize the important tissues to be considered in the interpretation of dental roentgenograms. (Fig. 3.)[6]

The important tissues to be considered are the (1) alveolar process; (2) alveolar crest or ridge; (3) lamina dura; (4) peridental membrane; (5) cementum and dentin; (6) enamel, and (7) pulp. Any change in the structure of these tissues is to be looked upon with suspicion.

Figure 1 shows cases of missing teeth. The premature loss of teeth is a contributing cause to periodontal disturbances.

Figure 4 illustrates the beginning of bone resorption. The process loses its pointed appearance, becoming flat in the space between the teeth. This condition may or may not be accompanied by irritation and infection.

Figure 1 also shows cases of periodontoclasia. There is marked destruction of

5. Merritt, A. H.: Periodontal Diseases, New York: The Macmillan Company, 1930, pp. 30, 70, 96.

6. Fixott, H. C.: Essentials of Dental Diagnosis and X-Ray Interpretation, Proc. Pacific Coast D. Conf., July, 1929.

the process with a definite dipping of the pocket toward the root of the teeth involved. As the condition is aggravated and progresses, we find a destruction of the dense structure of the lamina dura and a general diffusion of bone infection into the surrounding process.

We can follow the progress of tissue recession by periodic roentgenodontic studies, which should be made frequently enough to enable one to tell by comparison whether they have succeeded in controlling the condition or not.

It is usually necessary to make the first examination a combination of regular and bite-wing technic if we desire to obtain all the information possible from such an examination. (Fig. 1.)

Figures 5 and 6 show the value of combining the regular and bite-wing technic. Caries under a crown on an upper bicuspid and the depth of pockets are better shown in bite-wing than in ordinary films (Fig. 5) and a rough filling in the upper molar is better shown in ordinary than in bite-wing films. (Fig. 6.)

In Figure 7, we show destruction of the process involving the bifurcation of roots of upper and lower molars. This condition is one of the most difficult to determine without the use of the roentgen rays and probably the most difficult to control by treatment.

Figure 8 shows the appearance of calculus deposits on the roots of teeth, the cause of a definite type of periodontoclasia and of no little failure in treatment.

Modern methods of crown and bridgework and filling technic have largely eliminated overhanging rough fillings (Fig. 9) and oversize crowns (Fig. 10); but the fact remains that entirely too large a percentage of faulty fillings and crowns are adding their toll of sufferers from periodontoclasia and other periodontal disturbances.

A roentgenodontic examination is essential to the detection and correction of these conditions.

By causing a loss of contact, harboring fermenting food particles and bacteria, caries lends its aid to creating periodontal disturbances. (Fig. 11.) It has been proved many times that the roentgen rays intelligently used, will reveal from 25 to 40 per cent more caries than will be found by usual methods of examination.

Impacted teeth add their quota to the long list of teeth affected by periodontal irritation and its sequelae. Destruction of the process, the presence of a pulpless lateral incisor and irregularity of a central incisor, caused by impaction of a cuspid, are shown in Figure 12.

Figure 13 shows a retromolar space, a most favorable place to harbor infection.

A brief analysis of the figures given in the foregoing tables of statistics to note the frequency with which the conditions illustrated above occur may be of interest here.

Of the 1,000 persons examined, 97.4 per cent had lost one or more teeth (Table 1) and 19.6 per cent of all teeth were missing (Table 2). Thirty-six and five-tenths per cent of all teeth show evidence of bone resorption from the beginning to the coronal one-third of the root, and 13.4 per cent of all teeth have deep pockets and bone resorption extending beyond the coronal one-third of the roots. Some form of periodontal disturbance involves 49.9 per cent of all teeth (Table 5). Oversize, rough fillings appeared in 775 teeth out of a total of 25,112, or 3.08 per cent of all teeth (not of all filled teeth, but of *all teeth* in the examination of 1,000 cases), and 975 out of 25,112 teeth, or 3.9 per cent of *all teeth,* had oversize crowns (Table 5). Caries is

present in the mouths in 90.3 per cent of all cases (Table 1) and in 15.97 per cent of all teeth (Table 4). Six and two-tenths per cent of all third molars and 1.2 per cent of all cuspids are impacted or unerupted (Table 6). The damage caused by loss of teeth, caries, the presence of oversize crowns and rough fillings, impaction, malocclusion, etc., is largely preventable, thanks to the development and intelligent use of the roentgen rays in dentistry. The use of the roentgen rays in our practices, regularly, systematically and intelligently, pays dividends in satisfaction and success.

616 Medical-Dental Building.

SCIENTIFIC INVESTIGATION FOR THE GENERAL PRACTITIONER OF DENTISTRY*

By CHARLES F. BÖDECKER, D.D.S., F.A.C.D., and JAMES L. ZEMSKY, D.D.S., New York City

INTRODUCTION

THE leaders of the dental profession have realized during the last decade that the future progress of dentistry depends largely on activity in research. Our work in the past, which has been principally curative and reparative, has been crowned with considerable success. Now, the realization that this method of treating pathologic oral conditions is far from ideal is slowly creeping into the minds of dentists, physicians and health workers. Medicine has long realized that it is better to prevent a threatened illness than to effect a sometimes doubtful cure of an active disease. While this belief has been applied to the treatment of dental ills, it has met with less success than reparative procedures.

How can we prevent a threatened illness? The ability to do so presupposes a complete knowledge of the cause of the disease and a comprehension of the constitutional and environmental conditions which may affect its activity. Such a knowledge can be obtained only through scientific research.

Research activities have centered mostly in a comparatively few persons specially trained in this field. This group of men has amassed an enormous amount of theoretical information, some of which appears to have no practical value. To make the results of scientific research useful to humanity, we must have a close correlation of theoretical information with clinical observation.

Let us apply this fact to the dental field. The diagnosis of the pathologic conditions of oral tissues is based on information from two separate sources, i.e., clinical case histories and variations from the normal of diseased tissues and cells. This applies not only to the macroscopic but also the microscopic condition of the cells and tissues.

The macroscopic appearance and symptoms of the diseased oral tissues, as noted in gingivitis, dental caries, pulpitis, erosion, pyorrhea, etc., have long been recognized and are daily observed in clinical practice. The microscopic changes which take place in diseased cells and tissues of

*From the Research Department of Oral Histology and Embryology, Columbia University Dental School.

the oral cavity, even though studied in most dental schools, have been little regarded in clinical practice, for the reason that our knowledge of the basic sciences has not been sufficiently correlated with that obtained in practical clinical cases. The dental student, therefore, divorces this theoretical knowledge from the practical phases of dentistry. In the last two years of his professional training, the student too often centers all his efforts on the latter. The theoretical or basic sciences are soon forgotten. He is not to be blamed for this attitude, for he has not been made to realize that mechanical dental restorations are made on organs in vital connection with the body.

Leaders in dental education have long realized the necessity of dignifying dentistry by incorporating the sciences of anatomy, histology, physiology, pathology, bacteriology, etc., in the professional curriculum. More and more of this subject matter has been included; but the correlation of such theoretical knowledge with clinical practice has been slight. The dental student often leaves his school with the fixed idea that the basic sciences are of little practical value in the treatment of dental disease. The growing realization that the teeth are an integral part of the body, in the fullest sense of the term, now emphasizes the importance of integrating the basic sciences with the practice of dentistry.

The need of the dentist to apply such knowledge to clinical practice was brought home more forcibly by the discovery that dental focal infection may affect the health of the body. This is not all: the results of later investigations suggest that constitutional disturbances may also unfavorably influence the teeth during their formative stages, possibly even in adult life. When the dental symptoms which arise from systemic ailments are finally properly identified, the dentist will have a still more responsible position. The scope of our profession will be greatly broadened. It may not be at once apparent how this will operate. Patients consult their physician only after some palpable sign of an illness appears. The dentist, on the other hand, sees his patient in all conditions of health and disease. When our profession has realized that rampant dental decay, pyorrhea, malnutrition of the gingiva, of the pulp, etc., are results of systemic ailments, dentists will be in a position to warn patients of impending disease on the observation of such symptoms. Thus, some systemic ailments will be recognized at an earlier date and a cure more readily effected.

It is fully realized that much is still to be learned concerning the various symptoms noted in the mouth which may be an index of systemic conditions. The time is ripe for members of the dental profession to take an interest in these relationships and to make a systematic study of them. It is the dentists and the dentists only who can aid in the correlation of clinical dentistry with the basic sciences, for most physicians know nothing of the oral conditions: that field has been left entirely to the dentist.

To return to our original theme: Research is absolutely necessary to the future progress of dentistry. The following paper is very timely in that it points the way to stimulating investigation which would bring nearer the solution of many of our dental problems. As is very well known, research has different phases, roughly classed into: (1) theoretical information obtained through microscopy, chemistry, animal experimentation, etc., and (2) clinical observations of the symptoms of diseases.

The man of theory and the man of practice have too little contact in the

dental field. They appear to be aiming at different goals and I feel that they have little in common. This is wrong. I wish, therefore, to emphasize the statement that the future progress of research will depend on the proper integration of theoretical and clinical information. When this has been accomplished, it may be hoped that the cause of many dental ills will be discovered. Dr. Zemsky describes the method by which the dental practitioner may participate in research, and thus benefit both his patients and himself, and dentistry in general.

Numerous papers and books have been written on the various specialties of dentistry in their relation to the general practitioner. Everyone is familiar with such titles as "Orthodontia for the General Dental Practitioner," "Principles of Oral Pathology for the General Dental Practitioner," "Oral Surgery for the General Dental Practitioner," and the like. I have been interested in "popularizing" certain special phases of dentistry, having written several papers and a book[1] dealing with my own specialty in its relation to the general practitioner. Therefore, in offering the present discussion, I do not bring anything new to this field except the subject, for it must be granted that scientific research for the general dental practitioner, with which this paper deals, is rather a novel topic. In various previous publications, the part which the general dental practitioner can play in scientific investigation has been pointed out and the benefits that may be derived from such a participation were mentioned. In one of such articles, these were summarized as follows[2]:

1. Zemsky, J. L.: Outline of Oral Surgery for General Dental Practitioner, Brooklyn: Physicians & Surgeons Book Co., 1930.

2. Zemsky, J. L.: Hypercementosis and Heredity, D. Items Int., 53:335 (May) 1931.

BENEFITS TO BE DERIVED FROM A PARTICIPATION OF THE GENERAL DENTAL PRACTITIONER IN SCIENTIFIC INVESTIGATIONS

The benefits to be derived from a participation of general practitioners in dental research will be threefold: to science, to the public and to dental practitioners.

To science: Sufficient material can be accumulated to make it possible to draw a definite conclusion regarding some particular problem under investigation.

To the public: Roentgenographic examination, which is essential in research work that can be conducted by the general practitioner, will reveal many dental pathologic conditions which will require attention. This may be either preventive or curative.

To the dental practitioner: Contacts with new people in connection with scientific research will have a far-reaching effect. First, it will direct his interest in a special field of scientific research, which may prove a stepping stone to further his study in it, for there are undoubtedly many practitioners who have both ability and inclination to do original research but lack the opportunity. For them, this investigation may be the needed impulse. Again, it may bring a new interest to the daily grind and release the mind from the many irksome tasks it is called on to perform in the ordinary routine of work. Moreover, it will disclose the relation between dental and systemic conditions, thus giving the dentist a broader view of his work, which is usually the result of any research activity in a special field. Finally, it will arouse the interest of the patient in the work of the dentist. No mention need be made of the pecuniary benefits that may follow through contacts of the dental practitioner with new members of families that he treats, since these are

quite obvious and will doubtless repay his efforts many times over.

THE ATTITUDE OF THE GENERAL PRACTITIONER AS TO HIS ABILITY FOR SCIENTIFIC INVESTIGATION

It has been observed that scientific research is regarded by the average general practitioner as something entirely out of his field, and yet there is absolutely no reason for this. On the contrary, there are certain problems requiring research which lend themselves particularly well to investigation by the general dental practitioner.

Regarding the ability of the dental practitioner to conduct certain investigations which will further research, it can be said that fortunately some problems require absolutely no preparation in the sciences, and an efficient worker may be produced without the years of training and experience usually required to become proficient in research work. The only requisite for participation in the investigation of certain problems is strict adherence to the worked-out set of rules and the following of an outlined scheme which includes obtaining clinical histories, taking roentgenograms, making careful observations and a systematized recording of such data; all of which presents no difficulty to the dental practitioner.

THE PART OF THE PRACTITIONER IN CERTAIN SCIENTIFIC DENTAL INVESTIGATIONS

Since the part of the dental practitioner in the scheme of certain scientific dental investigations can be of great importance, his active cooperation is indispensable to its progress. How is this to be assured? There are two methods of procedure, one of which requires that the entire work of the individual observer be carried by him to completion, the other permitting the practitioner to accumulate all the data and then turn them over to someone properly qualified for final analysis, correlation and conclusions.

METHODS OF INVESTIGATION

The methods of investigation will be discussed in relation to (1) hypercementosis and (2) study of periodontal conditions. In taking a clinical history, some uniform plan of procedure should be adopted. In a recently published paper which deals with the subject of obtaining histories and keeping clinical records,[3] the "feature" of the methods used is shown to consist in the use of special charts supplemented with short notes, making a graphic record the reading of which is very easy. It should be remembered that it requires considerable time and effort to examine a patient properly, and unless the findings are fully recorded, the information thus obtained will not prove available and all the energy and time spent in investigating the patient's condition will be wasted. Not only should the record contain full information regarding the present and past family history and clinical and laboratory findings, but also the diagnosis, prognosis and method of treatment.

All patients who come to a dental practitioner may be divided into three classes: (1) those suffering from some oral discomfort such as pain, swelling, and a flow of pus; (2) those suffering from systemic diseases and referred either by their physician or coming on their own initiative, to determine whether their disease is a result of their mouth condition, and (3) those who are in the habit of being periodically examined.

It is an advantage, therefore, to have

3. Zemsky, J. L.: Clinical Case Records: Importance and Aid in Practice, D. Cosmos, 73:968 (Oct.) 1931.

a different form of record chart for each type of patient. Obviously, patients who come voluntarily or have been referred by a physician for elimination of oral foci of infection and who are seriously ill, presenting a long past and present medical history and requiring extensive laboratory investigation, such as to blood chemistry and serology, urinalysis and bacteriologic and pathologic examination will require bigger charts than do those who enjoy robust health and come regularly for periodical examination or prophylactic treatment. In the latter cases, a small chart with the brief notation "negative" or "none" opposite past history, family history, complaints, etc., is all that is necessary, and there being no laboratory reports, the records may be very concise. There is no objection to the use of one type of record chart, the only disadvantage being that a larger chart requires bigger files and more space, a matter to be considered when their accumulation is contemplated.

With regard to the form of record charts, there are no hard and fast rules. There are numerous types on the market, and as long as all the findings may be conveniently noted thereon, one type may be found as good as another. Uniformity of records is desirable, for it leads to systematic recording and thus proves efficient and expedient, as the operator will become accustomed to look for information required in certain places.

SPECIAL PROBLEMS SUITABLE FOR INVESTIGATION BY THE GENERAL DENTAL PRACTITIONER

Having alluded in a general way to the type of investigation which the general practitioner is fitted to undertake, we shall mention those problems which should be taken up for immediate investigation. These are: 1. Heredity and hypercementosis. 2. Is hypercementosis an arthritic disturbance? 3. Clinical significance of hypercementosis. 4. Study of periodontal conditions through clinical observation and accumulation of material for histological investigation.

HEREDITY AND HYPERCEMENTOSIS

Does Heredity Play a Part in Hypercementosis?—The general dental practitioner is particularly advantageously situated to study hypercementosis in its relationship to heredity. The first fact to be established is whether hypercementosis is a peculiarity similar to cataract in that it is transmitted from parent to offspring. And, if so, (1) whether hypercementosis, like cataract, passes to the child from the affected parent, i.e., the dominant, as well as from the unaffected parent, i.e., the recessive; (2) whether all of the offspring are affected or only some of them, and (3) whether the condition may appear at various ages, that is, at a period of life subsequent to the time when the patient was observed. The procedure of investigation, therefore, should be such as to answer all these questions, thereby furnishing an answer to the question as to whether heredity does play a part in hypercementosis.

Method of Investigation.[2]—To answer the various questions enumerated above, the problem should be attacked by the following method:

Investigators should examine the roentgenograms of all the teeth of patients, and the relatives of those patients who present hypercementosis, i.e., the dominants, should be interviewed. This will be the simplest way to begin, for the dominants are always easier to trace, as the peculiarity would then be transmitted directly from parent to offspring, this making it possible to obtain a continuous history. For this purpose, all the

teeth of all the relatives that can be reached should be roentgenographed. Thus, valuable data regarding the manner in which the descendants of the dominant are affected will be secured. These data regarding the individual members of the family of the dominant should then be tabulated, later to be correlated with similar findings in other families examined, and finally studied for the existing peculiarity, i.e., hypercementosis. Until the time arrives for such final analysis, all the records should be carefully indexed and preserved.

The analysis of the data should be based on the following: (1) sex of the dominant (male or female); (2) frequency of occurrence of hypercementosis in the children of the dominant (all childen, only a few, a number or none); (3) sex of recessive (male or female); (4) frequency of occurrence of hypercementosis in the children of the recessive (all children, only a few, a number or none); (5) frequency of period of reexamination of the recessive (years, months); (6) distribution of hypercementosis (general, local, what areas).

After such data are secured regarding each family examined, a comparison of a large number of such records will undoubtedly reveal the necessary information, which should be tabulated under the following captions: (*a*) percentage of dominants directly transmitting the condition (hypercementosis) to all their offspring; (*b*) percentage of dominants not transmitting the condition to all their offspring; (*c*) percentage of recessives transmitting the condition to their offspring; (*d*) percentage of recessives not transmitting the condition to their offspring; (*e*) comparative occurrence of hypercementosis through dominants and recessives (through which is the transmission greater?); (*f*) parental influence, if any; possible rôle of heredity in hypercementosis.

Part of the Practitioner in the Investigation.—As stated elsewhere, there are two methods of procedure. One of these requires that the entire work of the individual observer be carried by him to completion; the other permits the practitioner to accumulate all the data and then turn them over to someone properly qualified for final analysis, correlation and conclusion.

Those who elect to attempt the first method of procedure will greatly facilitate this research by following the scheme previously suggested.

Those investigators who prefer to confine their efforts to the collection of data will assist in the successful advancement and completion of this work by accumulating their material and recording it in accordance with the following rules: 1. Examine the roentgenograms of all the teeth of the patient. 2. If a number of teeth show hypercementosis as revealed by the roentgenograms, make a record, according to Rule 3, and file the roentgenographic series. 3. Record the following: (*a*) Chart of the dominant; this to include date, name, address, age, sex, whether married or single, number of children; (*b*) physical condition, present and past, and (*c*) condition of the "hypercementosed" teeth (vital, nonvital, carious, etc.) 4. Interview all possible relatives of the patient. 5. Roentgenograph all teeth of the examined relatives of the patient. 6. Indicate carefully on a chart all the available data concerning each relative examined, as indicated for the patient under Rule 3, stating in addition the relationship to the dominant, i.e., "brother," "sister," etc. This is very important.

Summary.—My personal study of this

problem conducted thus far leads me to the following conclusions:

1. Hypercementosis in teeth presenting no indications of any kind of irritation is probably due to other than local conditions.

2. The question of a constitutional component, possibly functional, chemical or structural, may be a causative condition in the ready development of that peculiarity of teeth termed hypercementosis.

3. The incidence of hypercementosis in three members of one family which was investigated by one of us (J. L. Z.) —a mother and two daughters—suggests the possibility of heredity as a factor in the condition.

4. Examination of a large number of families, some of whose members exhibit this characteristic, is necessary to establish the existence of such causal relationship.

5. Evidence of the existence of hypercementosis among various members of one family is readily gathered by the dental practitioner by roentgenographic study of his patients and their relatives.

6. Analysis of all the accumulated statistical data resulting from observations made by various dental practitioners will determine the causal relationship of heredity to hypercementosis.

7. If such analysis proves heredity to be a factor in the production of hypercementosis, in the sense in which brachydactylia, cataract and hemophilia are transmitted, the results of this investigation will also demonstrate the extent and manner of its transmission.

THE CLINICAL SIGNIFICANCE OF HYPERCEMENTOSIS

That the clinical significance of hypercementosis is especially fit for investigation by the dental practitioner is evident from the communication of Professor Bödecker which appeared in three leading dental publications.[4] Aiming to establish the nature of this peculiar condition and desirous to determine its clinical significance, Dr. Bödecker published a communication calling attention to the fact that "a perusal of our literature clearly indicates that the above question requires further consideration, for up to the present writing there is no unanimity of opinion on the subject."

He finds that:

> Views regarding the nature of hypercementosis held by various authors are diametrically opposite. Pollia refers to it as "pathological cementum," and Hopewell-Smith defines it as a "pathological overgrowth of cementum." Gottlieb, Orban and Kronfeld, on the other hand, look upon hypercementosis not only as a non-pathological but highly beneficial structure.

Bödecker states that an investigation has been undertaken in his laboratory with a view to establishing the status of hypercementosis and adds that "the study of this subject will require certain clinical data in order to define whether hypercementosis has been observed to have an effect on the body."

He continues:

> It is held that hypercementosis is the etiological factor of serious nervous manifestations (Endelman and Wagner) and that it gives rise to reflected and diffuse pain and discomfort (Bunting). It is also claimed that neuralgia, functional blindness, functional deafness, chorea, epileptiform fits, paralysis, neuralgia, insanity and other related conditions have been cured by the extraction of hypercementosed teeth (Burchard and Englis, Brubaker) and cases have been reported in which serious nervous manifestations such as chorea, epilepsy, paralysis and insanity have been traced to dental hypercementosis and have been relieved by the extraction of such teeth (Bunting).

4. Bödecker, C. F.: Hypercementosis: What Is It and What Is Its Clinical Significance? J.A.D.A., 17:2339 (Dec.) 1930; D. Items of Int. 52:984 (Dec.) 1930; D. Cosmos, 73:92 (Jan.) 1931.

Dr. Bödecker further calls attention to the foregoing contention of the writers named regarding hypercementosis, and points out that "it is not shared by a number of other investigators nor has it been the experience of a large number of clinicians." "To be of any real value," he maintains, "a view must be well founded, which is obviously not the case with hypercementosed teeth." With the hope of establishing the facts regarding this condition, Bödecker and I call attention to this matter, seeking to arouse sufficient interest in the subject to secure the cooperation of those members of our profession who have made any observations on this condition.

To get the needed information, Bödecker presents a list of questions the answers to which would furnish the necessary data and thus make it possible to establish the clinical facts on this important subject.

It becomes apparent from this how important a rôle the practitioner can play in solving this problem. In fact, it seems that the results of this investigation depend entirely on his participation and findings. It is very important therefore that a large number of practitioners should become engaged in a very careful study of this subject. To facilitate the task of such investigators, we would suggest that the practitioner follow the general scheme outlined in the discussion of the investigation of the relationship between hypercementosis and heredity described above.

Since the information desired in this case is different from that sought in consideration of the other problem, the plan of investigation demands certain modification. It is claimed that there are two groups of patients suffering from the presence of hypercementosed teeth, one of these presenting as symptoms various nervous manifestations, while the other suffers from reflected and diffuse pain and discomfort. Another point to be borne in mind is that, as has been shown, hypercementosis has been found in all teeth, i.e., normally erupted as well as malposed and impacted. It has also been observed on both vital and nonvital teeth and in teeth showing various pathologic conditions.

It must be ascertained, therefore, whether the patients who may be classified as belonging in either group 1 or group 2 are not suffering the effects of some other disturbances than hypercementosis. To determine this, it is necessary to eliminate all those patients who present various pathologic conditions of the teeth except those with hypercementosis. This would limit the investigation to a comparatively small number of persons with vital hypercementosed teeth.[5] Accordingly, the following method of procedure is indicated.

Method of Procedure to Determine the Clinical Significance of Hypercementosis. — Patients complaining of reflected and diffuse pain and discomfort and those suffering from various nervous manifestations should be subjected to a thorough roentgenographic examination of the teeth and the adjacent structures, to determine the presence of any pathologic process, retained roots and unerupted or malposed teeth, etc.

A complete history describing the patient's present and past general physical condition is taken and a full record of the mouth condition is observed and noted on the chart.

All pathologic and abnormal mouth conditions are to be eliminated except the

5. Zemsky, J. L.: Hypercementosis in Relation to Unerupted and Malposed Teeth, J. D. Res., 9:159 (Feb.) 1931.

presence of the vital teeth showing hypercementosis.

The patient's condition is to be carefully observed and any change painstakingly described.

The patient is to be watched for some time (about a year), and when no improvement is seen in spite of all the medical, dental and surgical attention given, the vital teeth presenting hypercementosis are to be eradicated and a detailed record of the patient's condition kept for as long a period as possible.

On the basis of the foregoing procedure, the following rules showing the successive steps in this investigation are suggested:

1. Select the patients: (*a*) suffering from nervous disturbances and (*b*) suffering from diffuse and reflected pain and discomfort.

2. Take a complete history.

3. Roentgenograph the teeth and jaws, bearing in mind that teeth may be found in any position in the jaws, and sometimes in the antrum and nasal fossa.

4. Chart the conditions revealed by the roentgenograms: (*a*) Note presence of hypercementosis. (*b*) Describe hypercementosis (diffuse, circumscribed, nodule, etc.). (*c*) Describe the condition of the surrounding structure (area of bone decalcification, area of bone condensation, periodontal disturbances, etc.).

5. Outline a plan of procedure (therapeutic, surgical or medical attention required).

6. Take photographs and roentgenograms of the removed hypercementosed tooth and preserve the specimen for histopathologic study by placing it in a receptacle containing a 10 per cent solution of formalin (40 per cent solution of formaldehyd). Do not fail to have a label attached in order that the material can be identified.

7. Observe the condition of the patient, noting whether there is any improvement and for how long.

8. Describe the condition of the patient, noting not only whether there is any improvement but also whatever other changes are taking place.

9. Report in the literature all the cases studied or submit them to Prof. Charles F. Bödecker, Research Laboratory of Oral Histology and Embryology, Columbia University, New York City, where it will be included in the material studied in connection with the particular investigation.

10. Refer to the other rules suggested for investigation by the general practitioner as described in this paper and make an effort to follow those which it seems advisable to follow.

Summary.—It is held by some investigators that hypercementosis is responsible for serious nervous disturbances and reflected and diffuse pain and discomfort. These views are not substantiated by others, and, as a result, a large number of teeth are being sacrificed. Therefore, an investigation of this problem is much needed, and a clinical study in such an investigation is of great importance. It is therefore necessary that the general practitioner participate in the research work conducted in this connection. He should select very carefully a number of suitable cases for study, patients suffering either from some serious nervous manifestations or diffuse pain and discomfort, but presenting no pathologic condition which may be responsible for these disturbances, except hypercementosis of vital teeth. If, in spite of the medical or surgical treatment received, their condition does not improve, the vital hypercementosed teeth should be eliminated and the patient watched to observe the effect. Carefully kept records are essential in

order to study the results and make any definite and reliable statements and draw final conclusions.

The practitioners who do not intend to carry this investigation to completion are advised to submit their findings and accumulated material to someone qualified to carry the investigation to completion.

RELATIONSHIP OF HYPERCEMENTOSIS TO ARTHRITIS

Is Hypercementosis a Form of Arthritis?—What was mentioned regarding the participation of the general practitioner in the research on "Heredity and Hypercementosis" holds true of an investigation of the present subject, "Is Hypercementosis a Form of Arthritis?" In pursuing this study, the investigator will find it convenient to follow some definite method of procedure and it is the intention to offer here a plan, which has proved quite satisfactory.

Method of Procedure.—The method of procedure in the study of the relationship of hypercementosis to arthritis, which had been previously discussed[6] is as follows: Every patient who, on a roentgenographic examination of some of the teeth, presents hypercementosis is subjected to a complete roentgenographic survey of the entire mouth. Those patients who present several teeth showing hypercementosis are selected for further investigation. Having been advised of the condition of their teeth as revealed by the roentgenographic examination, i. e., the presence of hypercementosis, the patients are advised regarding the desirability of having a roentgenographic examination of their hands for the purpose of ascertaining whether the dental condition (hypercementosis) is not a sign of an arthritic disturbance. After roentgenograms of the hands are taken, a complete history is obtained, followed by a clinical examination of the hands.

Plan of Investigation for the General Practitioner.—The plan of investigation for the general practitioner, in order to obtain material for a final pronouncement as to whether hypercementosis is a form of arthritis, must contain the following information: (1) a full series of dental roentgenograms; (2) a complete present and past clinical history; (3) roentgenograms of the hands; (4) a clinical examination of the hands, and (5) conclusions based on this information.

It is quite evident that all these steps can be easily carried out by any practitioner. Roentgenographic examination of the teeth is mere routine in the daily work of the dentist. Taking a case history is obviously no task for the dental practitioner, particularly if he once adopts a definite form. The roentgenographic examination of the hand should also present no difficulty to a man who is accustomed to handling an x-ray machine. The technic of taking a roentgenogram of a hand is rather simple. To get a correct position, the hands are placed with dorsal aspect flat upon a 5 by 7 inch roentgen-ray plate, which is exposed just as a dental film is. The developing, fixing and washing is identical with that of dental films, requiring only larger receptacles. For this purpose, any utensils sufficiently large to hold these plates will do. Those who would not care to equip their offices for taking large roentgenographic plates of the hand can go on with their investigation by following Dr. Ottolengui's suggestion, which is not only practical but also possesses some advantages over the other procedure. The interphalangeal articulation can be roentgeno-

6. Zemsky, J. L.: Relationship of Hypercementosis to Arthritic Disturbance, D. Items Int., 53:729 (Oct.) 1931.

graphed very satisfactorily on small dental roentgen-ray films. When we consider the convenience of taking and handling small films which do not require the breaking of the routine, the advantages are obvious. From this point then, Dr. Ottolengui's suggestion is very valuable. By taking enough films, all the joints of the hand can be roentgenographed and thus the condition of the interphalangeal articulation can be definitely ascertained. A dentist who takes an average of fifteen dental films of every patient whom he sees should not find any difficulty in making such a study of the hand. A slight modification of Dr. Ottolengui's method may prove of assistance. This consists in taking several small films at once, which would decrease the number of exposures, thereby diminishing the dosage of the roentgen-rays given to the patient, and at the same time reduce the amount of work. After the roentgenographic examination of the hands is completed, the condition revealed by the films is diagnosed. Since we are interested only in determining whether there is any arthritic disturbance of the bones and cartilages entering into formation of the joints, diagnosis is quite easy. A comparison of the form of the articulating surfaces and the thickness of the cartilages of the joints as these appear on the roentgenogram, with that of a normal articulation will immediately show whether the patient has arthritis deformans.

Any deviation from normal should be carefully considered and the necessity of consultation with a roentgenographer and physician and further study of such cases cannot be overemphasized.

Taking of Histories.—The histories of patients who are being studied in connection with this investigation must contain, in addition to other information ordinarily included in such records, notations as to whether they have been at any time suffering from any arthritic disturbances and whatever other data are available.

The clinical examination of the hands also should present no difficulty to the practitioner, for he is familiar with the appearance of normal hands and any abnormality will immediately attract his attention, not to mention the actual deformities present in advanced cases of arthritis deformans.

Compilation of Data.—To summarize the plan of investigation as it should be conducted by the dental practitioners, these rules are suggested. Having selected a patient presenting one or more teeth showing hypercementosis, the dentist should continue as follows:

1. Roentgenograph all the teeth of the patient.

2. Roentgenograph the hands. (All roentgenograms should be well fixed and washed, otherwise they become valueless and useless.)

3. Record fully the history of the patient, this to include the following: (*a*) date, name, address, sex, age, occupation, and whether married or single; (*b*) physical condition (present and past); (*c*) condition of teeth showing hypercementosis (vital, nonvital, carious, etc.); (*d*) condition of the joints: bone, normal or abnormal (describe change), cartilage, normal or abnormal (describe change); (*e*) findings (state what they are or write "negative").

Summary and Conclusion.—Hypercementosis is regarded by some investigators as a form of arthritis, a close relationship having been observed between the articulating structures of the hands and the roots of the teeth.

In order to prove definitely the existence of such relationship, study of a

large number of patients with teeth showing hypercementosis is necessary. Such an investigation is particularly suitable for study by the general dental practitioner. The method of the investigation consists in a roentgenographic examination of the articulating joints of the hands of the patients presenting hypercementosis, and clinical examination of the hands of those patients. Furthermore, a full clinical history is obtained from them.

Thus far, one of us (J.L.Z.) has investigated twenty-four cases of hypercementosis and failed to observe the existence of the relationship between the structures of the roots and those of the articulations of the hands. This observation seems to indicate that the existing relationship as described is probably merely coincidental and that hypercementosis bears no relation to arthritic disturbances. This opinion must under no circumstances be taken as a final pronouncement but demands a great deal of further investigation. The general practitioner, because of his particularly advantageous position in this investigation, will have the last say.

GATHERING OF MATERIAL FOR HISTOLOGIC INVESTIGATION

While there may be exceptions, as a general rule it can be stated that this investigation is beyond the scope of the dental practitioner. The success of such investigation will depend in a great measure on the aid that the practitioner will give to the research worker, which consists in furnishing him with material for study.

Undoubtedly, we have all observed that the views of the various investigators regarding periodontal conditions differ. As pointed out by Skillen, this is due to the fact that the entire question of periodontal pathology is yet unsettled and requires more study. Skillen holds that it is impossible "to make clear the abnormal without coming to some definite understanding as to what should constitute the normal, with which it may be compared." Hence, the need of further study and consequently the need of good specimens, for the supply of which the research worker must rely on the general practitioner.

Before presenting the technic describing the method of removing specimens, it is advisable to indicate the sources[7] from which the material can be obtained. These are: 1. Patients with serious systemic disturbances demanding the elimination of all possible oral foci of infection. 2. Patients with isolated teeth interfering with proper prosthesis. 3. Patients with treated pyorrheic teeth who decided to have them extracted and dentures made, the proper construction of which would necessitate the excision of the surrounding prominent ridges. 4. Patients presenting cysts and other neoplasms. 5. Patients presenting fractures, necrosis, osteomyelitis of the maxillary bones and other oral diseases demanding surgical removal of adjoining teeth. 6. Patients having prominent alveolar ridges and short lips.

In order to assure that the histologic material is suitable for investigation, its surgical removal from the surrounding tissues must be performed in such a fashion that the teeth are not displaced from their sockets nor is the gum torn away from the underlying structures. If this is not accomplished, the specimens secured are absolutely of no value for the purpose intended. It is for this reason that a brief description of such a procedure is presented.

Principle of the Technic.—The tech-

7. Zemsky, J. L.: Sources of Material for Histologic Investigation of Periodontal Conditions, D. Cosmos, 73:696 (July) 1931.

nic is rather simple and should prove effective in the hands of anyone who is accustomed to handling surgical instruments. It has been described in detail in a previous communication.[8] In this connection, drawings of specially prepared models were used in preference to actual cases. By means of these models, the technic had been demonstrated with much greater clarity than on patients. In the use of these models, certain features have been considerably exaggerated. This is unavoidable when a schematic method of presentation is chosen. In describing the illustrations, attention was directed to these exaggerations in order that no wrong impression be created. Thus, an effort was made to prevent the occurrence of any possible mistake in performing the operation.

Before we pass to a description of the technic, the general principle which is laid down as a foundation for this operation must be stated. This may be formulated as follows: No force is permissible during the entire procedure. To elaborate: Every incision must be deliberate, regardless of whether it is in the soft tissue and done by means of a scalpel, or in the hard structures and made with a special saw. After the specimen has been separated from the surrounding structures, it should merely be lifted off its seat. The reason for this is obvious: if the various incisions are incomplete, a considerable amount of force will be required to dislodge the section and this will result in tearing away the pericemental membrane from the bone or cementum, thus severing the attachment from the bone and the teeth, the existence of which may be the very thing one seeks to establish.

8. Zemsky, J. L.: Method of Securing Fresh Human Tissues for Histopathologic Investigation of Periodontal Conditions, Internat. J. Orthodon., 17:484 (May) 1931.

Technic.—After selecting the patient, the parts which have to be operated on are anesthetized, the conduction method being that of choice. The type of case herein described, as well as the treatment presented, is typical and therefore illustrative of the method offered.

The patient chosen had, for several years, been wearing a partial upper and a partial lower denture. The retention clasps of these dentures caused the formation of cavities in the supporting teeth and in addition there was a considerable amount of pus discharging from all the pockets around the teeth. The patient, who had been suffering from severe systemic disturbances, decided to have all the remaining teeth removed and have full dentures inserted. Since the ridges showed marked absorption, it was evident that the mere extraction of teeth would leave very marked prominences, making satisfactory restoration difficult. To ensure the construction of good prosthetic appliances, resection of the prominent ridges would have to be performed; therefore, the patient was subjected to the method of procedure herein described, with the same results as if an alveolectomy had been performed. In addition, excellent specimens for histopathologic study were secured.

Method of Procedure.—After the level to which the ridge must be reduced is approximately determined, two horizontal incisions are made, one labially, the other lingually. These are made through the mucosa and the periosteum, reaching the bone. The incisions are carried from the ridge on the right side to the ridge on the left side. Two additional incisions are made along each ridge starting at the horizontal incisions and running posteriorly along the ridge for about one-half inch. With a raspatory, the flaps are reflected. They are then held out by

means of a tissue retractor and thus the bone becomes exposed to view. The next step is the separation of the specimen from the underlying and surrounding structures. This can be accomplished with facility by means of a small circular saw. To prevent generation of heat, the revolving saw is kept moist. This is done by means of a small ear syringe filled with water, on which intermittent pressure is exerted. After the roots of the teeth have been cut across, together with the labial and lingual bone, the cortical bone posterior to the end teeth may be cut through with a chisel. The specimen is then separated and immediately placed in a receptacle containing a sufficient amount of 10 per cent formalin, where it is kept completely submerged. Those apices which remain in the sockets after the removal of the specimen are taken out with elevators. The rough edges of the alveolar process are smoothed off with bone files and flushed with warm saline solution to remove the débris, after which the flaps are coaptated and sutured. Five days after the operation, the sutures are removed. During this period the patient is instructed to keep the mouth clean, rinsing it with an antiseptic mouthwash. In about two weeks after the operation, the mouth is ready for the reception of a denture.

Preservation of Specimens.—After the operative work has been completed, attention should be directed to the specimen. If it is large and frail, containing more than three teeth, it is advantageous to tie it with a thread, which serves three purposes: (1) it makes the specimen easy to handle, i. e., remove or replace in the receptacle; (2) it helps to hold the specimen together, and (3) it is a convenience in attaching to the specimen an identification label. The specimen should be placed and kept in a glass jar filled with 10 per cent solution of formalin, in an amount from four to six times as great as the bulk of the specimen.

It is desirable to have a photograph and roentgenogram of the specimen, which is quite a simple task. As great care must be taken not to ruin the specimen by allowing it to dry, while the specimen is being roentgenographed or photographed it should be kept moist by touching it with a piece of cotton, saturated with formalin.

Summary.—There are six classes of patients that may serve as sources of material for histopathologic investigation of periodontal conditions. From such patients, specimens could be secured containing teeth with all adjacent structures in their normal relationship. These specimens, removal of which can be easily accomplished by the use of a circular saw, chisels and scalpels, offer excellent material for study. This method of obtaining valuable material for histologic investigation in addition greatly aids the prosthodontist not only by shaping the mouth but also by making it receptive to a denture within a short time.

GENERAL CONCLUSIONS

A participation of the general dental practitioner in scientific research is indispensable for the solution of some important problems and will prove helpful in the study of certain others. Besides, the participation of the dental practitioner in scientific investigation is highly beneficial to the public and to practitioners themselves. It is singularly fortunate that a number of problems which require solution can be successfully investigated by the general practitioner without any extensive preparation on his part; he merely has to work in accordance with some definite plan of procedure and follow certain laid down rules.

Among the problems that can be successfully studied by the general practitioner are those relating to hypercementosis. These are heredity and hypercementosis, arthritis and hypercementosis and the clinical significance of hypercementosis. In addition to this, he can also aid very materially in the study of periodontal and other conditions by gathering together a large amount of suitable material for histologic study for qualified research workers.

In all investigations conducted by the general practitioner, the following general rules must be observed in addition to the specific instructions included in the suggested plan of procedure:

1. Charts, photographs and roentgenograms should be kept together.

2. Copies of charts are made and kept on file, together with the duplicates of the roentgenograms and photographs and other parts of records.

3. The name and address of the investigator who does not intend to publish his findings himself should be written on every case record. One complete set of such records together with the roentgenograms and photographs are to be sent, if the investigator desires, to Dr. Charles F. Bödecker, professor of Oral Histology and Embryology, Columbia University, New York City. On receipt of the material, every contributor will receive from the department a note of acknowledgment, and when the findings are finally published, full credit will be given to him for his part of the work.

DIAGNOSIS AND MOUTH PREPARATION*

By JOSEPH E. SCHAEFER, B.S., D.D.S., LL.B., M.D., Chicago, Ill.

WHEN Dr. Besser extended an invitation to me to discuss the problem of "Surgical Preparation of the Jaws for Full Denture Construction," he indicated that the discussion time should cover forty-five minutes. Taking a conservative view of surgical preparation, I felt that that which I would have to say on this problem alone would take a much shorter period of time. Obviously, if the discussion were to cover the stated length of time, other related problems would have to be considered. I then talked with Drs. Schlosser, Hall, Besser and LaDue to get their opinion as to the discussion of the subject of surgical preparation, since they are concerned with the practical problems concerning what is to be done with a mouth prior to denture construction.

From Dr. Schlosser I learned that some prosthodontists were taking the stand that their problem began with the prenatal and postnatal care of the infant, the care of the child during adolescence and finally the dental care of the mouth well on through maturity, on the assumption that at some time the individual might require full dentures.

Well might Dr. Schlosser ask: "Since when has the prosthodontist been better prepared to direct the care of the mother during the prenatal period than the trained obstetrician? Since when has the

*Read before the Section on Full Dentures at the Midwinter Clinic of the Chicago Dental Society, Jan. 19, 1932.

prosthodontist been better prepared than the pediatrician who has the care of the child during the postnatal period and on through adolesence? Since when has the prosthodontist been better prepared to direct the care of the child's mouth than those men specializing in children's dentistry or the orthodontist who is called in where special problems of malocclusion present themselves? And, finally, since when has the prosthodontist been better prepared to take care of the mouth during maturity than the well-trained general practitioner?"

Granting that all of these services are within the domain of the prosthodontist, what would be his method of handling such a problem? The aim, of course, would be to so treat the individual that when he needed full dentures, he would have the most favorable type of arch formation for denture construction. Having this end in view, one asks himself, What would be the nature of the control that the prosthodontist would exer-

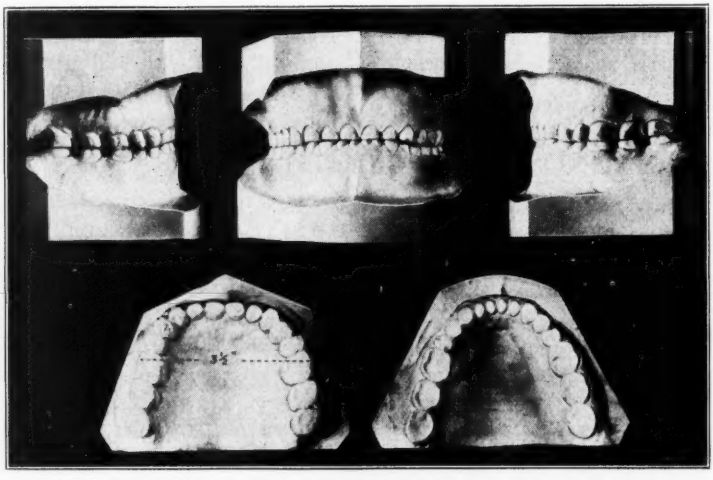


Fig. 1.—Jaws of primitive Eskimos.

The impracticability of such a stand on the part of some prosthodontists is evident. It would mean the direct supervision of every child born in America from the time of conception to the time when the teeth were lost and the skill of the prosthondontist was needed. I do not know the exact birth rate in the United States annually, but it must run into the millions. It would need not only great schools of prosthodontists, but several generations working with a community of interests, if the handling of such a problem were feasible.

cise? With a little reflection, one can see that the control measures could be divided into the environmental control of the individual and control of heredity.

The environmental control would have to consist of direction of the expectant mother regarding her diet during the prenatal period and postnatal control of the diet of both the mother and the infant, as well as of factors in the physical well-being of both mother and child,

and might include such other problems as proper rest, elimination and amount of sunshine.

No doubt, the prosthodontist would be very much interested in the calcium metabolism of both the mother and the child, for if his end object was the development of proper jaw types, the jaws being primarily osseous structures, he would necessarily have to be concerned with the amount of calcium in the diet.

Just last week, one of the manufacturers of accessory food products came to me with the plan of preparing special calcium tablets with a vitamin D content to sell to the dentist. "You know," he said, "the dentists are diet-conscious, and I feel that there would be a market for such a product among them." My immediate attack was: How could he be certain that his calcium product would be utilized and not pass out of the alimentary tract unabsorbed? Did he know anything about the mechanism of calcium fixation and, if so, could he exercise any control over it? Was he aware that the society of otolaryngologists had granted a sum of many thousands of dollars to study this problem of calcium fixation in order to determine the cause of otosclerosis, a progressive type of deafness due to a calcification process involving fixation of the stapes (one of the small ossicles in the middle ear) resulting in a profound conduction deafness? Competent research workers have been working on this last problem. Hospitalized patients suffering from otosclerosis were studied, careful chemical analysis being made to determine their exact daily calcium intake and output. The patient's calcium reserve was then depleted by removing calcium from the diet and stimulating calcium excretion. It was found that with an extreme depletion of calcium, it was not possible to influence the calcium deposits around the fixed stapes and consequently impossible to modify the deafness of these patients.

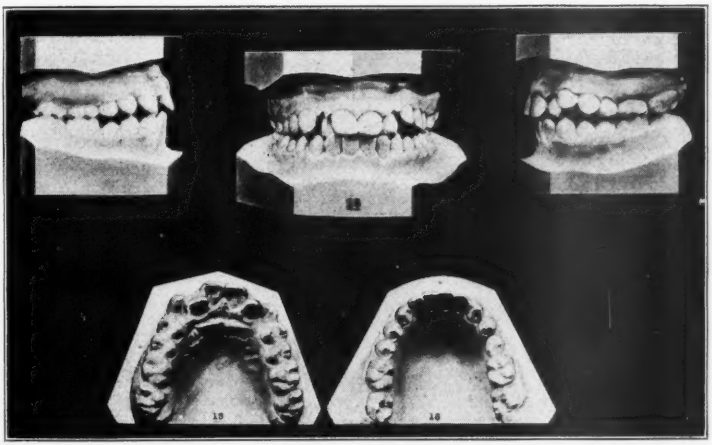


Fig. 2.—Jaws of half-breed Eskimos.

No improvement in the hearing of these patients, as determined by carefully performed hearing tests, resulted in these

carefully checked experiments on calcium metabolism. The most that these investigators could suggest was that the patient might be placed on a very low calcium diet in the hope that the deafness might not be progressive. Of course, they did not venture to surmise what might happen to these patients if they were depleted of calcium for an indefinte period of time. In other words, since so little is known of calcium fixation it is seriously questioned that we have any tangible control over the metabolism of this mineral at all.

I am always amused when I hear lay people, and some professional ones, talk so glibly about dietary factors. In this day of vitamins A, B, C, D, E, F and G, one wonders how primitive man ever survived; how our ancestors ever managed to be healthy without all this present-day scientific knowledge of these food accessories; how the biblical patriarchs ever managed to reach such ripe old age; how the longevity of the Bulgarian ever came about, with his complete ignorance of vitamins. So long lived were the Bulgarians that Metchnikoff, one of our leading scientists, became interested in their food habits and finally decided that it was due to their consumption of sour-milk products, as these contain acid-producing bacteria which change the character of the flora of the intestinal tracts, preventing protein putrefaction and its accompanying autointoxication, which, in turn, is said to produce early senile changes when not controlled.

Fig. 3.—Palatal forms of Caucasian, Negro and orang-utan.

Recently, Dr. Schlosser and I both saw a whole series of casts of the jaws of primitive Eskimos made by Dr. Waugh, of Columbia University, in an arctic expedition under a United States government commission. These casts represented strong massive jaws, teeth which were ground down into definite planes owing to a diet of dried walrus meat, but no evidence of caries. (Figs. 1-2.) Yet the diet of the Eskimos is made up of 65 per cent protein, the remainder being animal fat. How could these people be such sturdy types, with such excellent dentures, and yet be totally ignorant of dietary balances or vitamins?

Lastly, and to me most convincing, of our limited knowledge of proper dietary control, is the recent work of Dr. Davis. She hospitalized fifteen children, starting with some of them when they were 6 months old, and kept them under complete dietary control, a record being made of everything that they ate. These babies had about twelve foods, which, of course, represented a balanced diet, placed before them at each meal, but, and here the interesting part of the experiment came in, the child was permitted to make its own selection of the foods placed before it, and in no manner whatsoever was its choice ever influenced. In a moving picture of such a meal, one child was seen to help himself sixteen times to veal, taking a total of 400 gm. of protein. What were the results of such an uncontrolled selection? Rickets healed spontaneously; eczema disappeared in one instance, which had been aggravated by the mother's feeding but vanished on the child's selection of food. Fifteen children were fed

by this method over a five-year period. At the end of this period, all the children were well developed physically, and the dental examination revealed well-formed teeth with a single cavity and all fissures completely closed and calcified. None of the children had ever developed any gastro-intestinal disturbances, no child ever received a laxative and none of the children ever developed any feeding problems. The entire study suggests an innate biologic instinct in the selection of food evidenced when the child has the opportunity to select its own diet.

If we are concerned with the calcium problem, it is well to know that milk is the ideal source of this mineral. The growing child needs 1 to 2 gm. of calcium daily. A quart of milk contains 1.2 gm. The average adult requires 0.67 gm., and a glass of milk contains 0.4 gm. McCollum, one of our authorities on nutrition, in summing up an adequate diet, has this to say: "It should be made up of at least a quart of milk daily, plenty of vegetables and fruits, some of which should be fresh, and occasionally meat." Here is a practical common sense viewpoint of the entire dietary problem in health. With this knowledge, there is no need of manufactured products of specialized calcium preparations or any other food accessory,

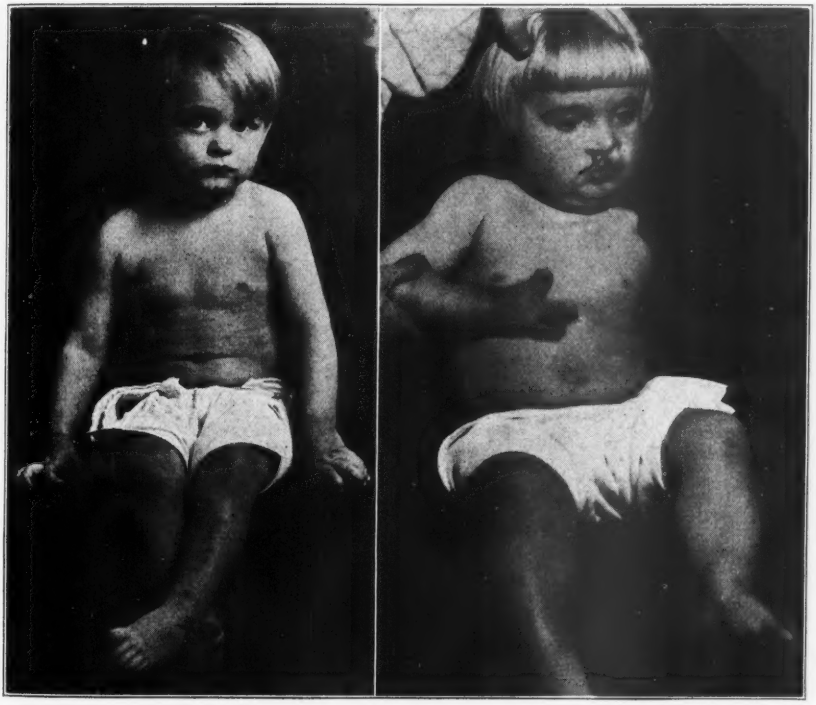


Fig. 4.—Left: Normal twin. Right: Twin showing multiple congenital malformations.

as far as our own dental problem is concerned.

I wish to call to attention to some of the dangers of indiscriminate feeding of calcium—particularly when given with parathyroid hormone: 100 c.c. of blood contains 10 mg. of calcium, a normal calcium content. Parathyroid hormone controls calcium concentration of the blood. Ingestion of an excess of the hormone results in an increase of blood calcium to 15.17 c.c., leading to death, usually with hemorrhage in the gastro-intestinal tract. If the hormone is given in small doses, metastatic calcium de-

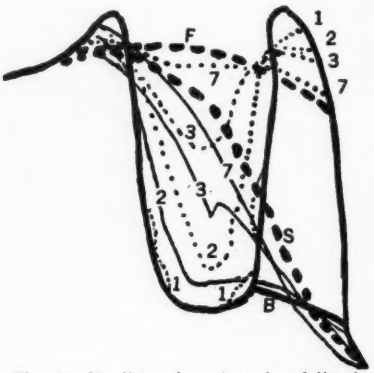


Fig. 5.—Healing of tooth socket following extraction by forceps and surgical method.

posits occur in the tubules of the kidney and calcified casts occur in the lumen. In the gastro-intestinal tract calcium deposits occur in the subepithelial tissues. In the lungs, deposits occur especially in the walls of the veins.

I have attempted to show that our knowledge of the whole dietary régime is to date too limited for us to make any claims for producing special bone or tooth conditions.

If we have no adequate control of the environmental factor in the problem of tooth or jaw forms, how much less control do we have over the hereditary factor?

Prosthodontists, on the basis of observation, have classified jaw forms into three types, tapering, oval and square. Now these are hereditary patterns. I was convinced of this when I saw Dr. Waugh's casts of primitive Eskimo jaws. Massive square types, over and over again, appeared as the dominant forms in his exhibit, but the moment we reached the casts from the half-breeds, we found a marked change in the jaw forms. From

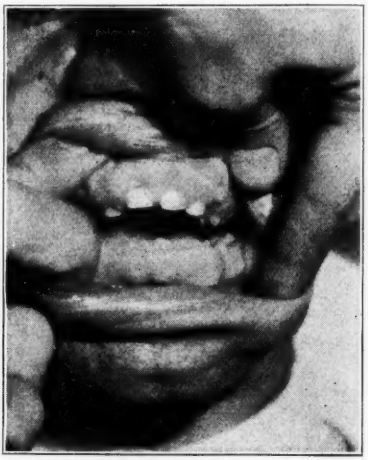


Fig. 6.—Extensive hypertrophy of alveolar bone and overlying tissues.

the square, primitive types they became tapering in one or two generations. In order to investigate further, I consulted the anthropologic department of the University of Chicago. Permit me to quote from a term paper entitled: "The Anthropological Aspects of the Palate with Special Regard to Some Peruvian and New Hebrides Skulls," by John Barnet Metzenberg.

Age, race and sex criteria on the skull have long been the subject for term papers;

no part of the body holds more information for the physical anthropologist in such a small area. It seems that the skull is found more often in a fairly decent state of preservation than any other part of the body. One very important criterion of race and age is the upper jaw, or the hard palate, formed by various processes of the maxillary bones and the palatine bone. The teeth proper are, of course, very important in determining age. Certain types of teeth are good racial criteria, but I shall only deal with the teeth in a very desultory way, making the bulk of this paper pertain to the hard palate.

The most obvious thing about the palate is the shape of the curve that the alveolar processes of the maxillary bones form. This

Fig. 7.—Case shown in Figure 6.

curve has racial significance. However, I believe that the curve of the alveolar processes proper is more important and more basic in determining race than the curve of the teeth themselves in the alveolar arcade. For example: On some Melanesian skulls I measured at the Museum, I found that while the curve of the tooth arcade proper was parabolic, the alveolar processes took a decided horse-shoe shape, turning in at the posterior end of the arcade. The distance between the lingual surfaces of the second molars, on a particular skull, was 45 mm., while the distance between the posterior lingual surfaces of the alveolar processes was only 32 mm. Practically all these New Hebrides skulls showed this decided serration at the posterior end of the palate while the curve of the teeth flared out considerably.

It is generally conceded that the form of the palate usually takes on the contours of one of two curves; either it tends to be U shaped, having the premolars and molars of one side more or less parallel to the same teeth on the other side, or it tends to the wider parabolic curve with a decided flare at the posterior extremities. From the drawing (from Wiedersheim) (Fig. 3) it can easily be seen that the difference does exist. I have found that the alveolar processes tend to be far more close to parallel than do the teeth. However in considering the palate, it must be remembered that the whole situation is

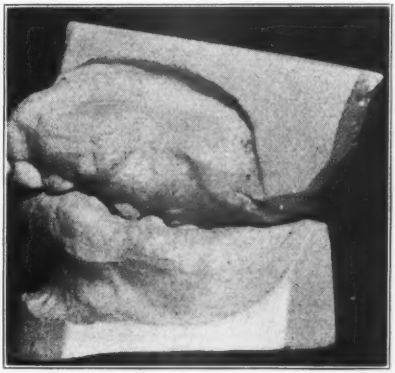


Fig. 8.—Case shown in Figures 6-7.

relative, not actual. That is, the width of the palate does not vary terribly much between races, but the actual difference is only brought out by the differences in length of the palate from the alveolar point to the tip of the posterior nasal spine. As soon as it becomes a matter of length of the palate, then prognathism enters into the discussion. On the quite prognathous skulls of the Melanesians, I found that the distance from the alveolar point to the posterior nasal spine was anywhere between 53 mm. and 65 mm. with the average running over 55 mm. On the Peruvian skulls that I measured I found that the whole shape of the palate was different, running to a wide parabola with an average length under 48 mm.

Now if the fundamental determining factor in jaw forms is on a hereditary basis, what possible control could the prosthodontist exercise over this factor?

Stockard, in a recent book entitled, "The Physical Basis of Personality," makes this statement:

> The chances that a given personality occurs is once in the possible combination of seventeen thousand with three hundred billion. The seventeen thousand represents the potential ova that could mature in the life time of a fertile female. The three hundred billion represents the number of spermatozoa that could be produced during the sexual activity of the male. Each possible combination of the product of these two numbers would produce a distinctly different personality.

The complexity of the problem does not end here, for the hereditary carrying elements are the genes contained within the chromosomes of a fertilized ovum. In the human ova, there are forty-eight such chromosomes. No one has determined the number of genes in each chromosome because these are hypothetical entities used to explain the possible endless factors representing both mental and physical characteristics which are to be transmitted by each fertilized ovum. If we take all of these factors into consideration, we have a problem which becomes so complex that it is incalculable.

In a recent textbook on prosthetic dentistry, I saw pictures of the various stages of the development of the human embryo. I asked myself what significance this has in denture construction. These pictures might satisfy one's curiosity as to what an embryo looked like, but have scarcely any other significance; for certainly, except to see to the general well-being of the expectant mother, we have no control over embryologic development.

I wish to show you pictures of twin brothers (Fig. 4), one a perfectly normal child, and the other having a harelip, a cleft palate, complete absence of the left arm; on the right hand, an absence of the thumb and fusion of the first and second fingers although the bones of both fingers are present; absence of the great toe on the right foot, and a rudimentary great toe and an absence of the second and third toes on the left foot. Now, here are two individuals with the same hereditary background, subjected to the same prenatal environment. Why is one child perfectly normal, and why does the other one possess so many congenital mal-

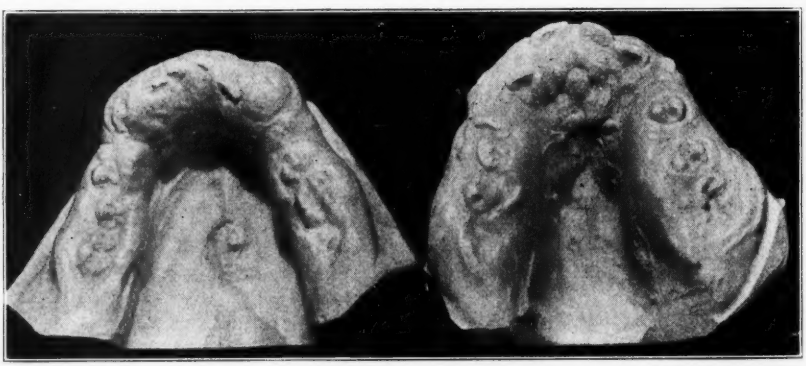


Fig. 9.—Case shown in Figures 6-8.

formations? Until we can answer such questions specifically, we had better realize how superficial our knowledge is on most biologic problems.

When we consider the complexity of all the problems involved in both the environmental and hereditary influences exerted on the human being, and, further, when we realize the inadequacy of our knowledge in controlling these conditions, well might the advice be given to the prosthodontist that is given to the shoemaker, "Stick to your last."

Let us approach the practical side of the question. Obviously, the problem of the prosthodontist begins when the patient reaches the point where he has lost most of his teeth and the construction of artificial dentures must be considered. I had charge of the denture construction and the extracting rooms at the Chicago College of Dental Surgery for a period of ten years. In those days, we pulled teeth, as we did not then talk of "surgical removal." We thought that we were very good at taking out teeth. Of course, in some cases, if the jaws were heavy and the teeth friable, the teeth would fracture off and we had to dig them out the best we knew how. After these extractions, the mouth would be slow in healing; small bone fragments would be ex-

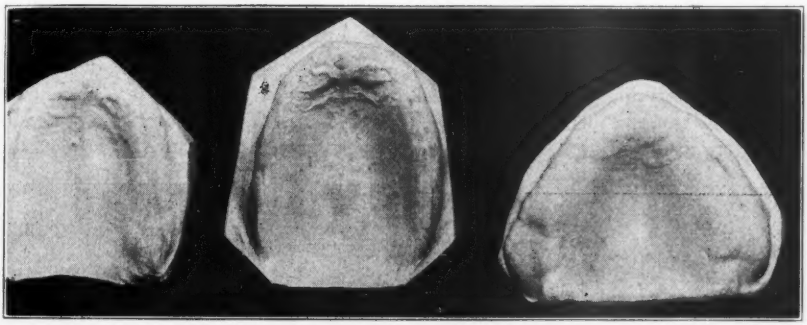


Fig. 10.—Plaster casts showing three types of upper alveolar ridges: square, tapering and ovoid.

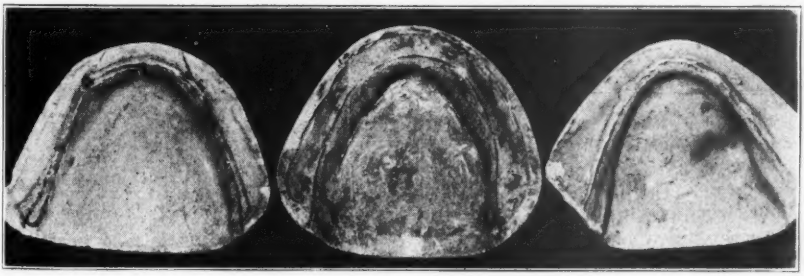


Fig. 11.—Plaster casts of lower alveolar ridges showing three types: square, ovoid and tapering.

truded, and, after the gums healed, in three or four weeks, there often remained sharp bony processes which caused great discomfort when dentures were inserted. We called these first dentures temporary plates and told the patient that they were good for only six months or so, sometimes less time, and, true enough, as the natural process of absorption went on, the plates became very loose. But in about one year's time, Nature had succeeded in most instances in absorbing all sharp corners and leaving very favorable residual forms. I wonder, in this day of surgical removal, when we strip the mucoperiosteum and chisel away freely the buccal cortical bone, whether the residual form has not been seriously harmed, to the ultimate detriment of the patient as far as the comfortable wearing of dentures is concerned. I wonder whether the patient would not often be immeasurably better off in the end if he or she paid two fees to the prosthodontist for two sets of teeth rather than a fee for surgical removal in addition to fees for dentures. Understand, I am not saying that after a full or partial extraction, a great deal of discomfort cannot be prevented; and much more rapid healing can take place if the sharp points of the alveolar process about tooth sockets are carefully smoothed off and the soft tissues closed by a few interrupted sutures. But when the procedure of surgical removal is carried to the point of trimming away whole plates of healthy cortical bone, it is objectionable and ultimately detrimental to the patient.

I think Dr. Schram's work on dogs in a study of the "Healing of Tooth Sockets Following Extraction by the Forceps and Surgical Methods," is quite convincing on this point. Figure 5 is a composite drawing showing approximate regeneration of bone following forceps extraction and surgical removal of teeth. The heavy continuous lines represent the outlines of the sockets immediately after the two methods of extraction, the line *B* indicating the position at which the buccal portion of the process was cut away in surgical removal. The light dotted lines show the progress of bone regeneration within the socket, and of absorption of the crest of the process in one, two, three and seven weeks after forceps extraction. The light continuous lines show

Fig. 12.—Portion of skull showing buccal erosion of apical ends of first molar and first bicuspid.

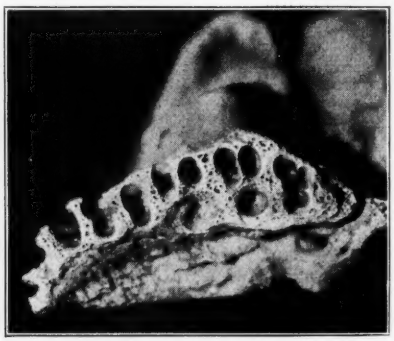


Fig. 13.—Portion of skull showing sharp edges of interseptal bone.

the bone rebuilding process two, three and seven weeks after surgical removal. The heavy dotted line *F* shows the approximal outline of the residual ridge after forceps extraction when reconstruction is complete. The heavy dotted line *S* shows the outline after surgical removal. It will be noted that a much heavier ridge remains after forceps extraction.

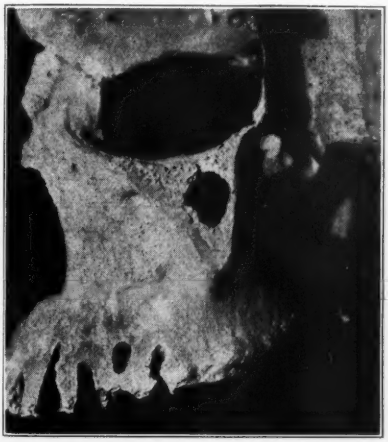


Fig. 14.—Case shown in Figure 13.

Fig. 15.—Model showing retraction of mucoperiosteum.

Occasionally one is confronted with extreme cases which require radical surgery. I shall show such a case, and Dr. Penhale will discuss the technic of mouth preparation as far as we believe it is advisable to carry it.

Figures 6-9 show an extreme case of hypertrophy of the supporting structures of the teeth. In this case, a radical alveolectomy was performed and all the teeth were removed. As the patient lives in the East, I have been unable to obtain photographs and casts of his present condition. He writes as follows: "Enclosed is a small picture of me which I took recently. I want to congratulate you on your work in making me a human being.

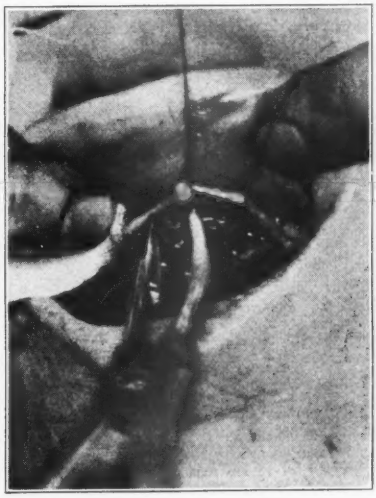


Fig. 16.—Cutting interseptal bone with rongeur forceps.

I am not having any trouble with my mouth and I feel wonderful, although I am sorry about my teeth."

TECHNIC†

I first wish to call your attention to the three types of jaws as classified by the prosthodontist: the square, the ovoid and the tapering. (Fig. 10.) Dr. Besser believes that the lower form is more diag-

†By K. W. Penhale.

nostic in making this classification than the upper. (Fig. 11.)

According to the anthropologist, the square, or U-shaped, type of jaw, in which the alveolar ridges on either side are parallel to each other, is the more primitive type. This was illustrated by Dr. Schaefer and is represented best in the orang-utan. The jaws of the primitive Eskimos, which were of the distinctly square type, as compared with those of the half-breed, also demonstrate the change in type from the more primitive to that represented by the Caucasian. The change which appears to take place affects the parallel lines of the alveolar ridges in that they become curved so that, either in the tapering or the ovoid types, the alveolar ridges take on the form of parabolic curves.

The technic involved in preparing a mouth for a full denture should always be kept as simple and conservative as possible. Experience teaches every man his own technic, and he employs those instruments that he can best use to obtain the results that he desires.

Full mouth roentgenograms are always advisable because of possible pathologic conditions such as the presence of imbedded root fragments, granulomas, residual areas of infection, cysts and submerged teeth. One can also determine more readily the number of pulpless teeth present and the curvature of their roots. These teeth often present definite mechanical problems because they are dehydrated and more liable to fracture in their removal.

The next question is the selection of the kind of anesthetic to be used, either local or general. The decision should be left entirely to the operator. In some cases, a patient might request one or the other type. Oftentimes, the operator can please the patient if the request complies with his own judgment in the matter. There is, I think, no question that, often, a much better result can be obtained under a local anesthetic than under a general because of the time element and the better control of the patient. The operator is not rushed and can remove whatever teeth he wishes at any particular time.

Proceeding, we will say, under local anesthesia, the next question that might arise regards which teeth are to be re-

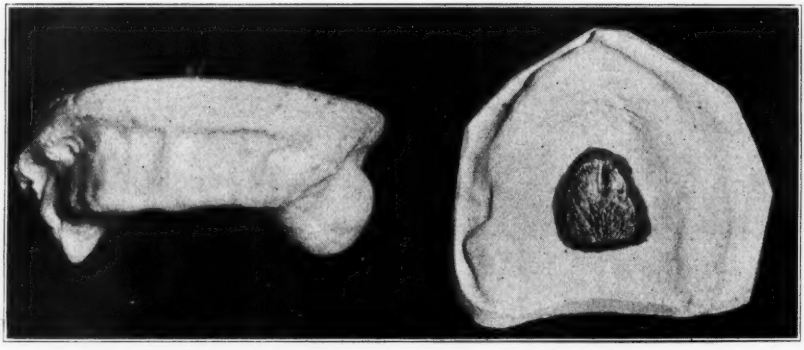


Fig. 17.—Casts showing protuberant maxillary tuberosity and torus palatinus.

moved first, or which arch is to be prepared first, the upper or the lower. It is probably advisable to prepare one or the other at one sitting. To prepare both arches at one sitting is quite an ordeal for any patient. For convenience, I shall start with the upper arch, and it is quite customary to start with the remaining teeth in the anterior region and then precede with the posterior teeth on either side. Sometimes, for cosmetic reasons, extraction is done at different sittings. Often, it is then advisable to remove the posterior teeth first, allowing the anterior to remain until there is some healing of the posterior ridges. The anterior teeth

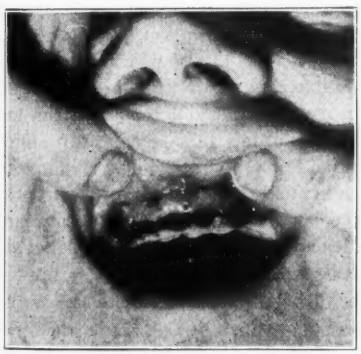


Fig. 18.—Coaptation of mucoperiosteum with interrupted sutures.

are removed later. Here, healing is much more rapid because the teeth are single rooted. This procedure is often of advantage because it reduces the edentulous time to the minimum.

Whether the teeth are to be deliberately extracted by means of forceps, or the soft tissues are to be retracted first remains for the operator to decide. If one suspects that there is erosion of the buccal or labial plates, which exists so often about nonvital teeth, as illustrated in Figure 12, it is very obvious that, in this type of case, there will be many sharp edges present even after the most careful extraction. (Figs. 13-14.) In anticipation of this condition, it is advisable to retract the soft tissues before the teeth are extracted. The interseptal tissue is cut with a knife, and the mucoperiosteum can then be elevated very easily by means of a blunt instrument. The teeth can be used as a rest while this dissection is being carried out. (Fig. 15.)

Often, one finds a thin margin of bone over the labial surface of the cuspid, and one knows for certain that, on removal of this tooth with forceps, a segment of bone is liable to fracture and come away with the tooth. Here, it is advisable to remove a small segment of the labial plate first by means of a chisel and thus prevent the fracturing off of a larger piece, leaving a very bad defect for subsequent restoration.

Assuming that all the upper teeth have been extracted, we next allow the soft tissues to fall into their natural position, and, by digital examination, we then feel lightly along the labial and buccal surfaces to discover any sharp edges of bone. It is quite important that these edges be removed either by a bone file or rongeur forceps. (Fig. 16.)

In most cases, this amount of so-called bone trimming is sufficient for all practical purposes and leaves the maximum amount of alveolar bone, which is important for the future stability and retention of the denture. Occasionally, in a case with marked protrusion of the upper anterior teeth, the labial plate may be removed for cosmetic reasons. Other exceptions to the routine preparation arise in those cases presenting a torus palatinus, a bony exostosis at the junction of the intermaxillary and palatine sutures. Unless these are so extensive as to interfere with denture construction,

they are best left alone, but they, as well as marked protuberant maxillary tuberosities, can be removed at the request of the prosthodontist. (Fig. 17.)

To continue with the routine procedure of mouth preparation: It is necessary to remove all of the sharp edges on both the labial and lingual surfaces as well as the interseptal prolongations. Each tooth socket should then be carefully explored for loose metallic, tooth or bone fragments, as these are foreign bodies and must be removed before suturing or before the patient is dismissed. A curet will do this very nicely, and if there are any granulomas at the apices of any teeth, they should also be gently removed. The soft tissues are now brought together, any loose tags removed with a scissors and a few interrupted sutures of silk placed. There is no necessity for placing many sutures. (Fig. 18.) All that is necessary is to hold the soft tissues in place for a few days; which will aid Nature in her repair. Ample drainage is a fundamental principle in surgery; tight continuous suturing violates this principle. Severe swelling of the face with infection has often followed when this principle has not been taken into consideration.

The lower arch is prepared in a similar manner, a greater attempt being made to keep all possible alveolar bone intact, which will aid greatly in the retention and stability of the future denture.

Schram's work on dogs, showing what actually takes place in bone as seen in microscopic examination, demonstrated that the periosteum did not lay down new bone. After several weeks, the microscopic sections showed that the repair of the bone was being made from the cancellous side outward. Now, whether this new bone ever takes on a dense cortical layer is questionable. Dr. Schlosser is of the opinion, based upon his experience, that the removal of an excessive amount of parent bone is ultimately damaging to the patient.

While it is true that a jaw trimmed to meet the requirements of the prosthodontist may withstand the immediate insertion of a denture with little discomfort to the patient, Dr. Schlosser believes that, where much parent bone has been removed, the pressure exerted on the alveolar crest by the denture in its distribution of the masticatory stresses hastens bone resorption. It is questionable whether this new cancellous bone laid down to repair the bone injury after a surgical removal is equal to the task of distributing these masticatory forces without itself undergoing rapid resorption. The greater the resorption of the alveolar crest, the smaller the total area of the denture surface. The smaller this total area becomes, the greater must be the distribution of the masticatory strain per square inch. The greater the strain per square inch of denture surface, the greater the ultimate resorption. Such a condition is known as a vicious circle. Here, then, we have a method which originally seemed advantageous to the patient, but when the end-result is taken into consideration, proves to be of decided disadvantage, and one which may ultimately leave the patient with jaws incapable of satisfactorily supporting dentures.

MANIPULATION OF FOOD IN THE CONTROL OF DENTAL CARIES AND SYSTEMIC PYORRHEA

By HAROLD F. HAWKINS, D.D.S., Los Angeles, Calif.

THE successful control of dental decay and systemic pyorrhea by the manipulation of diet based on biochemical tests opens up a new field of service to the dental profession.

Previous articles by me have shown that the major factors in dental caries and systemic pyorrhea were a faulty acid-base balance and calcium-phosphorus balance. In the active stages of caries and pyorrhea, we always have an acidosis, if we interpret an acidosis as a marked reduction in the alkaline reserve of the body. In active systemic pyorrhea, the saliva is usually neutral or slightly acid, but may be alkaline. In active caries, the saliva may be slightly alkaline or markedly acid. The opposite extremes in the calcium-phosphorus balance are found in active caries and pyorrhea. In caries, the blood serum calcium is high and the blood serum phosphorus is low, and in pyorrhea, the blood serum calcium is low and the blood serum phosphorus is high.

In caries, the salivary calcium is reduced below normal and the phosphorus is above normal. In pyorrhea, the salivary calcium is usually extremely high and the phosphorus although higher than normal is relatively low when compared to the calcium.

Table 1 shows observations rated from the average normal in caries and systemic pyorrhea. The calcium-phosphorus balance for saliva, blood serum and urine is given.

Table 2 shows typical saliva and urine balances. Those for caries and pyorrhea are an average of several hundred cases.

Our normal shows a saliva markedly alkaline and urine acid, but not excessively so. The calcium of the saliva is generous and that of the urine is low. The salivary and urinary phosphorus is harmonious with the p_H and shows good elimination through the kidneys.

TABLE 1.—CALCIUM-PHOSPHORUS BALANCE FOR SALIVA, BLOOD SERUM AND URINE

		Calcium	Phosphorus
Active caries	Saliva	Low	High
	Blood Serum	High	Low
	Urine	High	Low
Active systemic Pyorrhea	Saliva	High	Low
	Blood Serum	Low	High
	Urine	Low	High

TABLE 2.—TYPICAL SALIVA AND URINE BALANCES

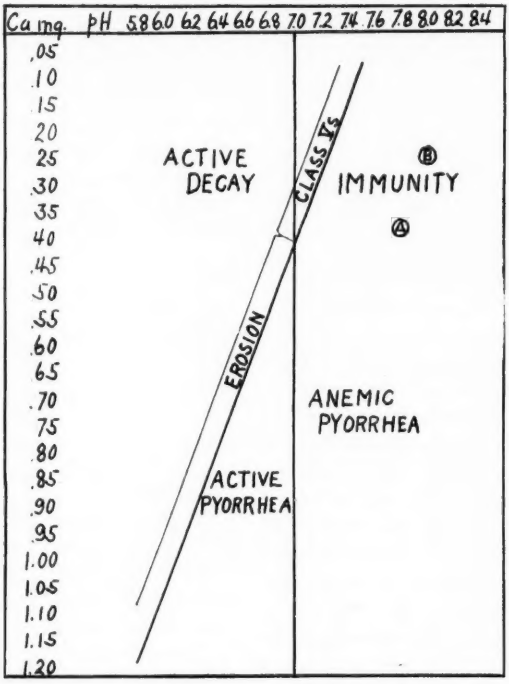
		p_H	Calcium	Phosphorus
Normal	Saliva	7.80	0.37	0.150
	Urine	6.00	0.12	0.600
Caries (Average)	Saliva	6.88	0.27	0.210
	Urine	6.87	0.20	0.403
Pyorrhea (Average)	Saliva	6.78	0.89	0.264
	Urine	5.68	0.19	0.818
Chronic Infection	Saliva	6.80	0.45	0.340
	Urine	7.40	0.10	0.250

The p_H of the urine is reduced in caries. It may, in some cases, actually be alkaline on a full night or twenty-four hour specimen. The salivary calcium is low and the urinary calcium relatively high. The salivary phosphorus is high and the urinary phosphorus low.

In systemic pyorrhea, the p_H of the saliva and the urine indicates too high an acidity. The salivary calcium is very high and the urinary calcium relatively low but still above the normal. The salivary phosphorus is high and the urinary phosphorus is very high.

In chronic infections, the salivary and urinary balances are quite similar to those of caries, with the exception of the urinary calcium loss, which, as a rule, is not great. The salivary calcium is not reduced.

The control of faulty metabolism, by the influence of different articles of food on the chemistry of the saliva and urine, is of great importance. We have found, at present, five ways in which the acid-base balance and the calcium-phosphorus balance can be influenced by food. Patients, free from infection and reasonably near normal, can, in a few weeks, be placed in or out of correct balance at the will of the operator. The influence of food on the saliva and urine is shown in Table 3. The upward pointing arrow indicates an increase. The downward



Relationship of acid-base balance and calcium-phosphorus balance to dental conditions.

pointing arrows denote a decrease. For the sake of clarity: a decrease of p_H means an increase in alkalinity and an increase in p_H means an increase in acidity.

If we consider the deviation from normal as shown in active caries, we see that division 1, the vegetables, potatoes and fruit, can be used to increase alkalinity. Division 2, meat, fish, eggs, American cheese, vitamin D, cod-liver oil and viosterol, supplies or increases the assimilation of phosphorus. Division 3, butter, cream, fats, and oils (in which the vitamin D content is low or absent) increases the alkalinity and decreases the calcium and phosphorus of the saliva. In the urine, the acidity, calcium and phosphorus are increased. This effect is desirable as regards the p_H and phosphorus and undesirable as regards the calcium of both the saliva and the urine. Division 4, cereals or grain food, is decidedly not indicated, as can be readily seen. It is chiefly, if not entirely, responsible for deviation from the normal as seen in caries. Division 5, milk, increases the calcium of the saliva. Its action in other respects is similar to that of fats and oils.

In systemic pyorrhea, the manipulation of foods would be as follows. Division 1, the vegetables, potatoes and fruit, should be greatly increased to reduce the acidosis. Division 2, meat, fish, eggs, American cheese and Vitamin D, should be greatly reduced. It is practically impossible to control pyorrhea if these items are in great excess. Division 3, butter, cream, fats and oils, has a very helpful effect on the salivary p_H. The increase in alkalinity improves the tone of the mucous membrane. Division 4, cereals, is not indicated and should be kept very low.

Cereals are quite high in phosphorus. Our diet studies indicate that as a person grows older, the ability to handle cereals increases. While children, as a class, cannot utilize the phosphorus from cereals, adults usually can. This class of food may be a very potent source of trouble to those with pyorrhea.

Division 5, milk, should be freely given in all cases of pyorrhea, as calcium has been shown to be low as compared to phosphorus in all cases of pyorrhea.

The importance of fats can scarcely be overestimated in the diet. They have a physiologic action entirely different from that of starches and sugars and appear to be one of the essential factors in

TABLE 3.—INFLUENCE OF FOOD ON THE SALIVA AND THE URINE

		p_H	Calcium	Phosphorus
1. Vegetables, potatoes and fruit	Saliva	↓	↓	↓
	Urine	↓	↓	↓
2. Meat, fish, eggs, American cheese, vitamin D	Saliva	↑	↑	↑
	Urine	↑	↑	↑
3. Butter, cream, fats and oils	Saliva	↓	↓	↓
	Urine	↑	↑	↑
4. Cereals or grain food	Saliva	↑	↓	↑
	Urine	↓	↑	↓
5. Milk	Saliva	↓	↑	↓
	Urine	↑	↑	↑

a balanced diet. The starch-fat balance has been recognized to be of great importance in controlling acetone acidosis. The total fat intake seems to be of more importance from the standpoint of acid-base balance and calcium-phosphorus balance than the relationship between starches and fats or the ratio of the former to the latter.

The way food may be manipulated to change the acid-base balance and calcium-phosphorus balance has been shown. A previous article[1] shows the relationship of these balances to dental decay, erosion, systemic pyorrhea and immunity to dental disease. The accompanying figure is a modification of a chart previously published which will make it possible to tell the exact dental condition at the time the tests are made and to trace the progress of a case. In the immune area, a small circle is shown marked *A*, which is the center of our conception of the ideal reaction for an adult. The small circle marked *B* is the ideal for children of 6 years or under.

Many patients report their general health greatly improved when their reactions are brought near the ideal. This is additional evidence of the correctness of the deductions.

It may now be said with certainty that every reasonably normal person who is free from infection may, by strict cooperation as to diet, place himself in such metabolic balance that dental decay and systemic pyorrhea are impossible.

Hawkins, H. F.: Dental Decay—What It Is and Means for Its Control, J. A. D. A., 16:781 (May) 1929.

HOSPITAL INTERNSHIPS FOR DENTISTS*

By DANIEL F. LYNCH, D.D.S., Washington, D. C.

AT a time when there is great controversy in the dental profession as to whether a dentist should have more medical education, one is forced to focus his attention on the possibilities in this direction that a hospital internship might offer. I have never met a dentist who has taken an internship and who has not been satisfied and glad that he spent the year in a hospital.

Some time ago, in a paper presented before a group of physicians, I stressed the importance of the dental intern to the hospital.[1] I tried to emphasize the fact that a physical examination of a patient is not complete without a thorough examination of the teeth and oral cavity. Certainly, the casual observation which is usually given to the teeth by the average physician in his examination cannot be considered a thorough mouth examination; and who is more competent than a man especially trained in oral diseases to examine and record the condition of the oral cavity?

If it is accepted that the presence of a dental intern in a hospital is a neces-

*Read at the Thirteenth Annual Meeting of the American Society of Oral Surgeons and Exodontists, Memphis, Tenn., Oct. 17, 1931.

1. Lynch, D. F.: Dental Internship in a General Hospital, J. A. D. A., 18:362 (Feb.) 1931.

sary adjunct to the house staff, one might ask the question: Of what benefit is the hospital internship to the dentist? Today, I shall try to tell you some of the advantages that a dentist may hope to derive from a year's residence in a Class A hospital.

It is well said that the first concern of a hospital should be the care of patient, with instruction running a close second. These are truly important objectives, calling for rare intelligence, abounding tolerance and an unselfish desire to serve. Certainly, they are two departments that a dentist could well afford to spend much time in, learning to care for the patient properly, and receiving more extensive instruction in his field.

Concerning the function of a hospital, Fishbein has recently said,

> Besides its first function—the care of the sick—the hospital is also concerned with the continuation of research in medicine and with the education of the public which it serves as a community center for health. There is no other institution of greater importance to the community than the hospital which serves as its health center.

If this is true, and since dentistry is a branch of the healing art, why should not dentistry be represented on the house staff of every hospital? Certainly, it is not that there is no need for a dentist in the hospital, since it has been very ably proved that all general hospitals can find room for the service of a dentist. In fact, in most hospitals, wherever the dental service has been well organized, there has been a desire to increase the staff of resident dentists. Some hospitals, e. g., Bellevue in New York, have six dental interns; Polyclinic in New York, three; the University of Michigan Hospital, two, and the Minneapolis General Hospital, two. If hospitals of such caliber and standing can find use for the service of the dentist, certainly the average general hospital has need of at least one dentist. Commander White of the United States Navy Department tells me that wherever dental officers have been assigned to hospitals and later removed, the medical department has set up a great demand for their return.[2] In such hospitals as the Brooklyn Naval, the Washington Naval and the Norfolk Naval hospitals, a physical examination is not considered complete until the dentist has made an examination of the mouth and charted his findings, which are kept with the patient's permanent hospital record.[3]

Regardless of the diagnosis, complete mouth roentgenograms are made for every patient entering these hospitals. Medical men and many dentists have the curious habit of not considering the teeth a factor in the patient's health if the systemic condition of the patient is not traceable to a distant focus of infection. The mouth and teeth of every patient should be examined regularly, regardless of the etiology of the disease. In other words, the examination of the teeth is one of the most important steps in preventive medicine and in preventive dentistry. Today, when a patient comes in for a complete physical examination, he expects that his mouth and teeth will be examined.

Not so long ago, in a paper read before the Annual Congress on Medical Education, Medical Licensure and Hospitals, Walter S. Goodale, superintendent of the Buffalo City Hospital, had the following to say regarding the reactions of patients to hospital administration and procedure:

> It may be that the question: "What is a complete physical examination?" now begins to formulate itself in the patient's mind. Over

2. White, P. G.: Personal communication to author.

3. White, P. G.: New Dental Ward, Naval Hospital, Norfolk, Va., U. S. Naval M. Bull., 22:433 (April) 1925.

the radio, he has heard members of the county medical society advocate periodic physical examinations. Although he entered the hospital fourteen days before, because of acute appendicitis, aside from the admission formalities and the operation, nothing further has transpired. There has been no examination of the eyes, ears, nose, throat or rectum. Nor can he recall having been examined by a dentist. No one has said a word about his old sinus trouble or the hemorrhoids that have bothered him for years. All this suggests the further question, "Why are doctors so insistently recommending complete periodic physical examinations for everyone, including those who are apparently well, when they appear to have neither the time nor the inclination to examine a man thoroughly and completely after he has entered the hospital with a definite illness?[4]

The recent and phenomenal growth of the large medical clinics and medical centers is a sign of the times. It is becoming a custom for busy people to go to a hospital or sanitarium for a few days' rest each year, and, while there, to receive a complete physical check-up. As this habit becomes more common, the demand for dental residents in hospitals and sanitariums will increase. One might say that it is a very simple matter to call in an outside dentist for consultation; but a dentist who is not trained in hospital procedure and hospital routine is liable to make many mistakes. As an illustration: He may find that it takes him a long time to care for a few cases; whereas, if he knew hospital routine, he would be able to simplify the procedure without offending any of the consultants.

One of the great problems in medical education is how to teach students more about the reaction of their patients. If this is true in medical education, it is certainly true in dental education. Most dentists spend a great many years making costly mistakes in trying to learn how to handle their patients. We receive courses in dental school telling us how to make better fillings, how to make better dentures and how to extract teeth painlessly, but there is no course in the curriculum that I know of that teaches the student how to manage the patient successfully; and even if there were a course in the college curriculum planned to teach the subject, I doubt that it could be done from the lecture platform, since this course is a clinical one, and the subject is only to be learned by the student through actual contact with his patients over a long period of time. The dental infirmary is not the proper place to learn this subject, since the student is continually working with an inferiority complex, because of the direct supervision of the demonstrators. In the hospital, the situation is different. The intern is encouraged to take responsibility, and to feel a personal interest in and responsibility for the patient. In fact, the intern in the hospital is a very important cog in the wheel of clinical medicine or dentistry, and he is made to realize it.

One of the most important things that dentistry needs is to find out, in ways not yet discovered, the sort of character the young man brings to the dental profession. If it is true that we are going to deal with doctors of the community, trained men who are going to practice dentistry, we must have men who can see the patient as a whole and who can grasp the needs of society. We must discover, in order to find out what his character is, some method of inquiring into the dental student's attitude toward life. What better place have we to observe and to develop in the young dentist the right attitude toward life than in the hospital that is properly supervised? In this day, when the dental profession is hearing so much about economics and

4. Goodale, W. S.: The Patient, Some of His Reaction to Hospital Administration, J. A. M. A., 94:906 (March 29) 1930.

high-pressure salesmanship, it is a very easy thing for a young man to get the wrong professional slant on life and his patient. Dentistry is not a trade, it is a profession, a calling, and only men of the highest ideals should be privileged to take the dental course. A man going into dentistry should be made to realize that the main purpose of his life will be service. The highest form of service is the hardest type to evaluate, and, oftentimes, one must give more than he receives.

Physicians are accustomed by long training to give much of their time to work in dispensaries and free clinics. It has been said that this is one of the ways in which they obtain experience; but certainly, in getting this experience, they do a tremendous amount of good. If, for a long period of time, physicians have found it advantageous to give much of their time to work in free clinics and hospitals, why is not the same procedure of advantage to dentistry? I feel that any procedure which has been found good in medicine will invariably be found good in dentistry.

There is prevalent an idea that all men who take dental internships must specialize in oral surgery. This is an erroneous impression, and one not borne out by facts. As an illustration, the Fifth Avenue Hospital, New York City, which, to my mind, offers one of the best dental internships in this country, has had eight men complete their service, and only one of these is now engaged in the practice of oral surgery. The other seven are practicing general dentistry, and I am sure that they are working on a higher plane than it would have been possible for them to have done without their hospital experience. I have talked to some of these men, and they have assured me that such is their feeling in the matter.

Let me quote from a few letters that I have received from former students of mine whom I urged to take such internships. The first man writes:

> The past year has been an extremely pleasurable and profitable one for me—pleasurable because it has brought me into intimate contact with a group of professional and scientific men, who, by their teachings and counsel, have broadened my knowledge of dentistry and medicine to an extent exceeding my highest hopes; and profitable, because it has given me the confidence and ability to apply this knowledge in the operating room and at the chair.

Another writes:

> At the conclusion of my period of hospital service, I feel that the advantages of an internship for the graduate dentist cannot be too strongly impressed on the profession. The vast experience acquired, and the confidence a year of hospital internship instils in one, is unquestionably worth while.

Another says:

> Personally, I feel much better equipped in fundamentals, experience and confidence than I did a year ago, and would say for those who can, to pick themselves a good hospital, and try to get in. I am sure I will never regret this year's work; the experience is well worth while.

These are only a few of the many letters that I received from men all over the country. They all speak with the same enthusiasm.

The year spent in a hospital, free of financial worry and responsibility such as plague most men during their period of striving in dental school, allows the young man time to rest and reflect a bit concerning life, and gives him ample opportunity to plan his actions for the future leisurely. Furthermore, the contacts one makes while in a hospital are often beneficial. Assuredly, if a man desires to locate in a certain town, a year's internship in the foremost hospital in that town will give him access to the friendship of the best physicians and dentists. It will also give him time to make friends with patients in the hospital, and when the

young man is ready to open his office, he does not feel that he is alone in the world.

The writing of the medical history of a patient is an important step in arriving at a correct diagnosis. The writing of a dental history should be just as important. While in the hospital, a dentist soon learns the value of a good history and it becomes a regular procedure for him to take a dental history of every patient. How many times have you been called to examine a patient in a hospital and, on arriving, been handed the chart, to find it nothing but a voluminous bundle of uncataloged notes? You could spend hours wading through it. There is an art in recording one's findings, and an intern soon learns that brevity and clearness in charting notes is very valuable. Involved sentences with many highly specialized dental terms should be avoided, and simple expressions common to both physicians and dentists be used.

It is in the hospital that the young man learns to do things in a systematic manner. He learns to organize his movements, to summarize his findings and to make a concise diagnosis.

Such training is absolutely necessary for the dentist of the future if he is to take his rightful place in working out the various research problems presented by present-day dental practice. It is interesting to note that Palmer and Carr have the following to say:

> The detailed study of the relation of disturbed function to altered structure has given us our fundamental conception of pathology. This has been done so completely in the bacteriological laboratories, with the aid of animal experimentation, that the focal infection theory seems fundamentally sound and acceptable. The fact that the etiology now seems clear, in many cases previously thought to be idiopathic, would indicate that the next step in progress must be made through the channels of clinical experience and close observation at the bedside. This must be based upon the fundamentals of internal medicine, and becomes a study of the symptomatology of disease in its relation to clinical pathology. It must include a study of an extended series of carefully selected cases, fully recorded in a systematized tabulation. This is indeed a problem calling for the closest cooperation between the medical and dental professions.
>
> While much space has been devoted to the subject of focal infection in the form of reports of medicodental cases, the presentations which attempt to show cures, or failure to cure, have been lacking in scientific background. This is due to the incompleteness of histories and their lack of correlation with the clinical pathology of the case. The failure to devote sufficient consideration to the post-discharge follow-up is also a universal deficiency. Most of the reports submitted have been practically worthless because an unbiased analysis of them leading to a scientific conclusion has not been possible. This demonstrated inadequacy of the records is undoubtedly due to the lack of a systematized routine manner of recording the facts.[5]

Until very recent years, little attention was paid in dental schools to the diet of patients. In the hospital, the diet is a very important item. The dental intern soon learns to order specifically for each patient, and, as he is ordering, he is forced to consider various conditions that contribute to the patient's health and comfort. For instance, it would be most unwise to order a regular diet for a patient with a fractured jaw. In these cases, a liquid diet must be given, with feedings more than three times a day. Patients who have had impacted teeth removed should not be kept on a soft diet longer than is necessary. Accordingly, the dental intern must be observant and anticipate the needs and desires of his patients. In other words, the dentist, while in the hospital, learns a great deal about the value of food, and what he may expect from prescribing different items on

5. Palmer, B. B., and Carr, M. W.: A Systematization of Clinical Study of Focal Infections, J. D. Res. 6:271 (Sept.) 1924-1926.

the menu under certain conditions in the treatment of various diseases.

To a man with an interest in preventive dentistry, many problems present themselves in the course of an internship. At the present time, I know of one hospital that is experimenting with a raw basic diet in preventive diseases, particularly in children. Although this work has just begun, they are expecting good results; but regardless of the outcome, the many phases of experience that will be presented for discussion will teach the intern much about biochemistry, blood chemistry and other phases of body function. The interns on the service in the hospital where this work is being carried on have become increasingly interested in the problems as the work has progressed. In fact, both the medical and the dental men are getting a great deal of pleasure out of working together on this problem.

In most dental schools, general anesthesia is considered a postgraduate course. Although lectures are given in general anesthesia, little clinical experience is afforded the student. The average dentist has little opportunity to gain experience in general anesthesia unless he places himself under the tutelage of a man of much experience in this work. There are few dental schools offering a good postgraduate course in general anesthesia. Most of the courses are offered by the manufacturers of gas machines. In the hospital, the dental intern has the opportunity to give general anesthetics. If he has ability and the inclination, he can take a regular tern on the anesthetic service along with the other interns. In this way, he learns to give all types of general anesthesia for all kinds of cases, and, during the course of a year, he gains a wide clinical experience that will be of much benefit to him later on in his practice.

The values of preoperative medication and postoperative treatment are impressed on the dental intern. Some medical men have standing orders for all their cases, while other men leave no orders at all. The dental intern soon observes that patients who have been premedicated often get along better than those without medication, and, in his work, he attempts to get better results by watching the cases more closely before the operation. The value of postoperative care is also stressed. It is often the quality of postoperative care in operations that determines whether the result will be good or bad. It is such details as preoperative and postoperative care that the dentist has impressed on him while in the hospital because he is able to watch his case continually over a long period of time. This is not possible in the average dental office.

While in the hospital, the dentist has the opportunity to observe the effect of different sedatives on patients and, as a result, dosage begins to take on a new significance to him. He learns to avoid a hit-and-miss procedure for a definite technic in the administration of sedatives.

His list of efficient narcotics is augmented and their actions on various types of patients is permanently cataloged in his mind because he has had the opportunity to observe these actions over a long period of time. This is the kind of materia medica that stays with us longest.

All well conducted hospitals hold periodic staff meetings, which should always be open to the interns. Such meetings are held monthly in most hospitals, although in the full time staff institutions a weekly meeting is conducted in which the interns take an active part. At these meetings, interns should read at least one paper each year, usually based on a clinical study of a large series of cases taken from the hospital records, with a review of the literature bearing on the subject under consideration, the papers to be discussed and criticized by the men of the staff. But this is not enough; besides the regular staff meetings

and the clinicopathologic conferences, a series of seminars, arranged especially in the interest of the intern and dealing with all of the major specialties, should be conducted by the members of the permanent staff. The roentgenologist should have periodic meetings in his department during which films are examined and roentgen diagnosis and differential diagnosis thoroughly discussed. All this may seem somewhat utopian but may be easily arranged and is no more than the conscientious staff should feel it owes the younger men.[6]

The dental intern has a chance to attend all necropsies, and therefore gain an intimate knowledge, if he so desires, of pathologic anatomy. He can observe work in the delivery room during his turn on the anesthetic service.

By attending staff meetings, medical seminars, roentgen-ray conferences, medical rounds, conferences on pathology and on surgery, etc., the dental intern soon picks up a vast amount of valuable information that he could not otherwise get.

From my point of view, the greatest lesson which a dentist learns while in the hospital is his respect for asepsis. Too often in dental schools, this important subject is not stressed. One or two lectures in it are expected to last a man a lifetime. Yet, in a hospital, the dentist soon learns to do as the other interns do. His appreciation for a sterile technic is greatly enhanced, and, as a result, he tries to put dental surgery on the same plane as general surgery by following the procedures in asepsis which a general surgeon would follow during an operation. It is a comfort and pleasure for a dentist to feel, in an operating room, that he is following out the accepted methods of procedure, and not to be fearful of making a mistake that will break the chain of sterility. It is only by long experience and much time spent in the operating room that this confidence and comfort can be achieved.

Instead of increasing the predental years, would it not be more profitable to give the dentist more extensive postgraduate instruction? At the present time, there are not enough facilities for postgraduate instruction of dentists; yet, if all hospitals had dental internships, it might be possible to so standardize them that the dentist could expect, and be assured of, a certain definite and broadening experience.

I have previously classified dental internships under three types: (1) the general type; (2) the institutional type, and (3) the permanent staff type.[1] The general type would include all dental residents in general hospitals who receive no remuneration for their services except experience, room, board, and laundry. The institutional type would include all dental residents in sanatoriums and state institutions, such as the insane asylum, houses for the poor, aged and chronic invalids, jails, penitentiaries and houses of correction. The permanent staff type is the clinic or house staff dental service. This type would include all dental residents in special hospitals, large clinics, and state and government institutions (such as veterans' hospitals).

Each of the above-named types of internships has its adantages and disadvantages, and they offer a wide choice of service for the dentist seeking hospital experience. If he has an inclination for oral surgery, preventive dentistry, pedodontia, periodontia, etc., I would advise him to take the first type of service. For the man wishing wide experience in prosthodontia, crowns and bridgework, operative dentistry, exodontia, roentgenography, etc., I would advise the institutional types of service. The permanent staff type will vary with the kind of in-

6. Foss, H. L.: Hospital Training of Interns, J. A. M. A., 96:1004 (March 28) 1931.

stitution. It may be that a dentist is wanted for just prosthetic work, or he may be wanted for operative procedure or for oral surgery.

The point that I wish to bring out is that all dental internships are not the same, and it is wise for a dental student contemplating a year's service in a hospital to consider carefully the type of institution. For instance, at Bellevue Hospital in New York, which has six dental interns, a rotating service is employed which is divided into four quarters of three-month periods. The first quarter, the intern spends in diagnosis and roentgenographic work; the second, in exodontia and anesthesia; the third, in ward service, which implies taking care of inpatients in hospital. In the fourth, he confines his work to fractures. The interns work under the supervision of an assisting visiting dental surgeon, who is in charge during clinic hours, which are from 9 in the morning until 5 in the afternoon.[7]

In the Minneapolis General Hospital, the internships are offered with a view to giving the recent graduate an opportunity to broaden his knowledge of dentistry along medical lines and to further his training in the special field of dentistry that is presented in the hospital. The type of work in the dental department includes oral surgery, extracting of teeth, oral diagnosis, roentgenography, periodontia and prophylaxis. A restorative clinic is also conducted, the work consisting of denture construction and plastic fillings. There is also an orthodontia clinic. The dental interns divide their time between the work in the dental department and work in the wards. Ward work includes examination of the mouths of patients in the wards, assisting on the major surgery service and ward rounds in medicine. Research work is encouraged. The intern is expected to become interested in and to work out a research problem during his period of residence.[8]

The close cooperation and the spirit of working together which is engendered by the dentists' and physicians' association in the hospital is bound to lead to mutual problems of research. If the dentist and physician learn to work together in the hospital, there will be more cooperative research work later on in their practices.

I have tried to present a concise view of the need for better dental service in hospitals and of the important benefit the hospital internship can be to dentistry. I realize that there are many things which I have omitted, having in fact only scratched the surface of the possibilities in this direction. When more dentists have taken hospital internships, the opportunities of such a service will be greater because the good which they will do the patient, the hospital and themselves will lead to standardization and concentration of effort in this direction. I do not present this data with an evangelist's enthusiasm, nor am I unmindful of the fact that this is not a new idea. I have endeavored only to present a fresh view of the field in which I feel that dentistry can find a greater sphere of usefulness. I am sure that immediately after graduation we all feel a certain internal weakness and a desire for more experience. Possibly, for the dentist of the future, the hospital offers that haven in which a dentist can develop confidence in himself and at the same time have the opportunity to render service to a class of people in dire need of dental attention.

7. Winter, Leo: Personal communication to author.

8. List, W. E.: Personal communication to author.

DISCUSSION

Theodor Blum, New York City: We are not interested in dental interns; but we are interested in the appointment of dental surgeons to the hospitals, and we can't have the surgeon unless we have the dental intern. While still a student, I made up my mind that a medical student should go into a hospital as soon as he left school. He does not know so much as the nurse does when she graduates after only two and a half or three years of hospital work, for the simple reason that the nurse is there day and night and has the actual experience, which most physicians and dentists do not have when they get out of school. The dental internship is very important, and if I had my way, a dentist or a physician would not go into practice until he had spent at least one year in a hospital. This period of training serves a number of purposes. First, poor people who are not able to pay for dental services could be served by the dental intern, under the supervision of the official visiting dentist. This would solve a great need. The dental hygienist also should have a year of service in a hospital or institution where people who have not the means to seek private service could be taken care of. Every patient admitted to the hospital should have prophylactic treatment. It seems absurd that a patient is brought into the hospital and washed from head to foot, and no attention is paid to the mouth. It seems unthinkable that such a large number of medical practitioners and surgeons do not realize how important it is, especially if the patient is to receive a general anesthetic, to have the mouth taken care of. There is only one hospital that I know of in the United States, and that is one in New York, where Dr. Franken is the visiting dentist, where every patient is taken care of in that way. Something should be done about it, but what can we do? I discussed this subject with Dr. Lynch on the way down here, and we thought that it would be best, first of all, to have the American Medical Association, in its next report, state in the report of hospitals how many dental interns they have in each hospital. This would be very little work, and when we have all these facts and are in a position to speak, we should communicate with the American College of Surgeons and suggest that they do not call a hospital a grade A institution unless it has the required number of dental interns and assisting dentists in the hospital, in relation to the number of beds or the number of patients admitted to clinics.

George Frank Seeman, Nashville, Tenn.: Each man should go back to his own community and see if he can't introduce dental service into the hospitals. It is as important for a dental graduate to have an internship as it is for a medical graduate. The latter would not think of doing without an internship.

Oather Allen Kelly, St. Louis, Mo.: I do not believe it is altogether the fault of the hospitals that so few of them have a dental service or dental internships. There is something attractive about an internship from a medical student's standpoint, or from a graduate student's standpoint, that is not offered in the dental internship. For instance, in the general type of hospital, which Dr. Lynch mentioned, when they have dental service at all, it is usually afforded by one dentist who is a member of the visiting staff of the hospital. He goes only on call. He goes only when a patient has a fractured jaw or something of that character, and the service is not attractive to the dentist. For instance, this condition existed: In the table of organization in the city hospital in St. Louis, there is provision made for a dental intern, and for a period of eight years, they were unable to get a graduate dentist to serve as intern, because the service there was not attractive. A young physician goes into the hospital; different men bring their patients there, and he has the opportunity of observing the older physician at work. He gains a great deal of experience; whereas, in the dental department, there is only one man, who comes in only occasionally. The service is not attractive. I do not believe that we can expect to take a dental student out of school today, place him in a hospital as an intern, and have him to do a great deal of work, unless he has a great deal of initiative. I believe that it is our duty to become more interested in hospital service, and we can do so by doing more of our work at the hospital than in the past. Dentists are reluctant to send their patients to the hospital on account of the additional expense, but when the situation is analyzed, the service might be made as reasonable as it can be given in our offices. For instance, a man who has an inclination toward surgery must have an elaborate equipment. He must have autoclaves and an enormous outlay of

instruments in order to do surgical work in the proper manner; whereas, if the hospital were well organized and had good service, one inclined to practice surgery could send his patients to the hospital and not have the heavy office expense.

Boyd S. Gardner, Rochester, Minn.: We must consider that a physician, after he graduates, can't take the state examination until he has served as intern in a hospital. Dentistry is where it is owing to the attitude of dentists toward dentistry. As Dr. Kelly said, it is not the fault of hospitals in communities, but of the attitude of dentists in that community toward this hospital service. Why is it that men who have been out as long as I have, or nearly as long, are not at home in hospitals doing their work? They prefer their own offices, merely because they do not relax when they must prepare themselves for operating beside a surgeon who is, perhaps, going to perform an appendectomy. We must think of our work for the future, not for today, and it behooves every dentist to do what he can to educate the hospital as regards dental internship in his community.

Dr. Lynch: We have more to get out of the hospital than the hospital will derive from our work. As Dr. Kelly says, before a young man is allowed to go to a hospital, we should be very sure that the hospital is going to give him a training that is worth while. For this, a good chief of dental service is most necessary. Too often, and this is one of the reasons that dental students have gone into institutions and have left before their term was up, a man is appointed chief of service for political reasons, and not because he has the ability and the desire to work. If he is on that staff, he should go into the hospital every day, regardless of whether he is called or not. If he will do that, and there is a young man in that hospital who has just graduated from school, the latter will take an interest in his work and prepare the case histories; and if the chief, when he comes in, instead of passing them over, as he usually does, will look over them carefully, criticize them and make the intern feel his work has not been wasted, and then they will examine the cases together and the chief point out the things the younger man has overlooked in his examinations, it will be good for both of them. We learn a great deal by going to the hospitals, and as a result, when the physicians see the dentist coming into the hospital, they call him into consultation more often. By examining all of the ward patients, the intern gets a broad experience. He talks with the medical intern, and the medical intern can see definite results from the elimination of oral sepsis. He is impressed. He doesn't have to read about it in textbooks; he sees it. He tells his chief, say, on the urologic service, and presently the chief of the urologic service is calling the dentist in to see cases which are not in the charity wards. That makes it profitable to dentist, patient and hospital. The profession must standardize the dental internship and the work of the chiefs of the service, and I am sure most of you, if connected with hospitals, would not be indifferent, but conscientious, and it is out of such conscientious service that good fruits will grow.

QUANTITATIVE BACTERIOLOGIC STUDY OF PULPLESS TEETH CORRELATED WITH DENTAL ROENTGENOGRAMS*

By H. C. CRAMER, D.D.S., and
ALLAN F. REITH, Ph.D., Milwaukee, Wis.

FOR years, the pulpless tooth with painless apical involvement has been the subject of conflicting discussion. At present, it is agreed by most dentists and physicians that the frankly diseased tooth is a menace to health. It remains to be demonstrated conclusively what the dependable criteria of significant dental infection may be. Dental roentgenograms are in general use to determine the condition about the apex of a tooth. These, because of imperfections of technic and the limitations to which any mechanical aid is subject, allow many differing interpretations and much controversy as to their reliability. Conflicting findings and conclusions of men working in the pathology and the bacteriology of this field have added to the confusion.

Several bacteriologic studies of the pulpless tooth have been presented during recent years, but because of frequent error, due to contamination, it has been impossible to draw satisfactory conclusions correlating roentgenographic changes with bacterial growth.

Haden[1] cultured 1,307 teeth and arbitrarily regarded ten colonies or less as representing possible contamination. Eliminating such questionable cultures, he found 5 per cent of vital teeth, 44 per cent of teeth negative on roentgen-ray examination, and 63 per cent of teeth positive on roentgen-ray examination to give growth in deep agar culture. His standard of roentgenographic interpretation is not given, and a rather broad classification of the tooth negative on roentgen-ray examination, which has been customary heretofore, may account for the high percentage of these teeth which gave growth. A number of teeth positive on roentgen-ray examination gave no growth. Cultures of these teeth were made from the clipped root apex only, the granuloma being disregarded. This method, which is believed to be misleading, will be discussed later.

Henrici and Hartzell[2] cultured the pulp of 105 vital teeth. When pyorrhea was present, 42 per cent of the pulps were found infected, while 43 per cent of the pulps of carious teeth gave positive cultures. Similar results have been obtained

*From the Department of Preventive Medicine, A. O. Smith Corporation.

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1. Haden, R. L.: Pulpless Tooth from Bacteriologic and Experimental Standpoint; J. A. D. A., 12:918 (Aug.) 1925.

2. Henrici, A. T., and Hartzell, T. B.: J. D. Res., 1:419 (Dec.) 1919.

by others. Unless the caries or pyorrhea was advanced, these results seem high for vital teeth.

Rickert, Lyons and Hadley[3] cultured seventy-four pulpless teeth, of which 43 per cent gave growth, but the condition of the root apices is not reported. In the same study, ten of seventeen vital teeth had infected pulps. The latter group was selected because of the presence of atrophic or degenerating pulps, but the criteria used in selection are not given.

Fig. 1.—Group 1, cuspid, pulpless, roentgenographically positive. The tooth apex showed no growth; granuloma, more than fifty colonies.

No constant relationship between cultural findings and roentgenographic conditions has been demonstrated in previous investigations, and, as a result, there has been a general feeling that it is difficult, if not impossible, to distinguish clinically the infected from the noninfected pulpless tooth. Such conclusions should not be accepted as final. The different reactions seen roentgenographically in the bone about the apical areas of teeth must have some meaning. The present study was undertaken to establish more definite criteria for translating such roentgenographic changes in terms of infection.

TECHNIC OF OBTAINING CULTURES

The area about the tooth to be extracted was isolated by gauze packs and scrubbed with hexylresorcinol. The field

Fig. 2.—Group 1, lateral incisor, pulpless, roentgenographically positive. The tooth apex showed no growth; granuloma, fifty colonies.

was allowed to dry and 5 per cent iodin applied. We did not rely on this procedure to eliminate bacteria in the free-gingival margin, as we feel this is impossible in the mouth. After the iodin had dried, the tooth was removed with care to avoid contact as far as possible. The tooth was then immersed for ten seconds in 95 per cent alcohol to allow thorough contact with uneven surfaces. To eliminate surface contaminants, the alcohol was then ignited by rapidly passing the tooth through a flame. About 0.5 cm. of

3. Richert, U. G.; Lyons, C. J., and Hadley, F. P.: Etiology of Root Canal Infections: Nature of Causative Agents and their Behavior with Respect to Elective Localization in Rabbits, J. A. D. A., 13:1213 (Sept.) 1926.

the root apex was then clipped into a sterile test tube containing 2 c.c. of 1 per cent gelatin in Ringer's solution and about 1 gm. of sand. After five minutes of vigorous agitation in a mechanical shaker, one drop of the fluid mixture was then streaked out on a fresh blood agar plate and quantities of 0.1 and 0.3 c.c. were pipetted into tubes of glucose-beef heart-agar. The residue in the tube (liquid, sand and tooth apex) was poured into a tube of glucose-brain broth agar. The base of all culture mediums was veal infusion containing 2 per cent peptone and titrated to a reaction of

Fig. 3.—Group 2, first molar, pulpless, with periapical change, and growth of six colonies.

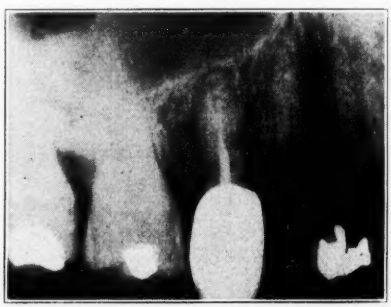

Fig. 4.—Group 2, second bicuspid, pulpless, with periapical change; no growth.

p_H 7.4. Blood-agar was prepared by adding 5 per cent rabbit blood and 2 per cent agar. Glucose-beef heart-agar was prepared by dissolving 0.2 per cent glucose and 0.3 per cent agar in the broth and the solution was tubed over about 2 gm. of ground beef heart. Glucose-brain broth was prepared by adding to the veal infusion 0.2 per cent glucose and to each tube about 2 gm. of calf brain. Results were read after twenty-four and forty-eight hours' incubation. Bacterial colonies on the plates were roughly identified by gross and microscopic examinations and colony counts were made from the agar tubes. These methods are in general similar to those described by Haden.

It was shown in preliminary control tests that teeth sterilized by autoclaving, allowed to dry over night at room temperature and then dipped in a bacterial broth culture gave variable results when cultured after surface sterilization as described. Growth in cultures thus obtained was assumed to be due to the excessive drying of some teeth, the bacteria-loaded broth into which they were dipped being drawn by capillary attraction so deeply into the teeth as to escape the surface sterilization by alcohol and flame. To determine the correctness of this assumption, tests with dry and with moist teeth were conducted separately.

Teeth were thoroughly washed, placed in Petri dishes and autoclaved at 20 pounds pressure for twenty minutes, and were then kept in a desiccator for six days. Other teeth were placed in Ringer's solution and autoclaved. Each tooth was then taken with sterile forceps, dipped for about one second in a 20-hour bacterial broth culture and immediately thereafter in 95 per cent ethyl alcohol for ten seconds, then passed through a flame to burn off the alcohol and the apex clipped into a sand tube and cul-

tured as already described. A strain of *Streptococcus viridans* and of *Staphylococcus albus,* previously isolated from teeth, was used in the test. In each of the dry and moist series, nine teeth were tested as described with each strain. In addition, three teeth were cultured without having been passed through the flame and one tooth was cultured without sterilization in either alcohol or flame. The summarized results are shown in Table 1.

It is evident from these results that the alcohol-flame method of sterilization is efficacious for moist teeth. None of eighteen moist teeth thus sterilized produced visible colonies in agar mediums and only one gave growth in broth. On the other hand, each of eighteen dry teeth gave colonies in agar mediums. Since, at the time of extraction, teeth are "moist" in the sense applied here, we assume from the results of this experiment that the method of sterilization used does eliminate surface contaminants.

In a more critical experiment, sterilized and thoroughly dried teeth were soaked in a 24-hour broth culture of *Streptococcus viridans* for ten minutes, removed to sterile gauze to drain for about three minutes and then dipped rapidly into a broth culture of *Staphylococcus albus,* and finally surface-sterilized with alcohol and flame, and cultured. Of nine teeth passed through alcohol and flame, two gave no growth and the remaining seven yielded growth of streptococci only. All of three teeth which were incompletely surface sterilized with alcohol only, as well as one tooth cultured without passing through alcohol and flame, gave growth of both streptococci and staphylococci.

These control experiments satisfied us that contaminating bacteria adhering to the surface of a tooth may be destroyed by the alcohol-flame method and that this surface sterilization does not materially inhibit growth of bacteria present in deeper portions of the tooth. We then undertook a quantitative bacteriologic study of freshly extracted teeth, in the manner previously described. Only teeth with definite roentgenographic characteristics were used, to avoid errors in classification. Interpretation of all dental roentgenograms was made and recorded previously to the report of cultural findings; and, similarly, the bacteriologist had no knowledge of the roentgeno-

Fig. 5.—Group 3, second bicuspid, pulpless, roentgenographically negative; no growth.

Fig. 6.—Group 3, second molar, pulpless, roentgenographically negative; three colonies.

graphic status of the tooth. The teeth were divided into four groups.

Group 1: Pulpless Roentgenographically Positive Teeth.—Teeth in this group showed frank rarefaction or marked osteosclerosis in the roentgenograms.

Group 2: Pulpless Teeth with Slight Periapical Change Only.—This group included those teeth showing in the roentgenogram a broken lamina dura or cortical line; periapical proliferation of the peridental membrane; slightly increased calcification of the bone adjacent to the root apex, or a moth-eaten appearance of the bone about the apical area, probably indicative of disintegration of occasional bone trabeculae without organized rarefaction.

Group 3: Pulpless Roentgenographically Negative Teeth.—Teeth in this group showed in the roentgenogram a definitely outlined intact alveolar wall, unchanged lamina dura and surrounding bone with clear detail and normal appearance for the particular anatomic area in which the teeth lay.

Group 4: Vital Teeth.—All vital teeth selected for culture were from fairly clean mouths and were free from marked caries. A few teeth with moderately large fillings in good condition were included.

A summary of the bacterial count of 200 freshly extracted teeth surface sterilized and classified as described is given in Table 2.

No originality is claimed for the method used in obtaining bacteriologic cultures for this study. Hatton[4] suggested the method in an interesting study of the relation of pathology and bacteriology of teeth and Rickert[3] used a somewhat similar method in obtaining cultures from pulp canals. Some refinement of technic and considerable control work to determine the efficacy of these methods have been added. By laboratory experi-

TABLE 1.—CONTROL TESTS WITH DRY AND MOIST TEETH

Test Organism	Teeth	Sterilization	Growth in Glucose-Brain Broth	Colonies in Glucose-Beef Heart-Agar
Streptococcus viridans	8 dry	Alcohol and flame	Streptococci	More than 50
Streptococcus viridans	1 dry	Alcohol and flame	Streptococci	20
Streptococcus viridans	3 dry	Alcohol	Streptococci	More than 50
Streptococcus viridans	1 dry	None	Streptococci	More than 50
Streptococcus viridans	8 moist	Alcohol and flame	None	None
Streptococcus viridans	1 moist	Alcohol and flame	Streptococci	None
Streptococcus viridans	2 moist	Alcohol	Streptococci	More than 50
Streptococcus viridans	1 moist	Alcohol	Streptococci	35
Streptococcus viridans	1 moist	None	Streptococci	More than 50
Staphylococcus albus	6 dry	Alcohol and flame	Staphylococci	More than 50
Staphylococcus albus	3 dry	Alcohol and flame	Staphylococci	9, 13, 16
Staphylococcus albus	3 dry	Alcohol	Staphylococci	More than 50
Staphylococcus albus	1 dry	None	Staphylococci	More than 50
Staphylococcus albus	9 moist	Alcohol and flame	None	None
Staphylococcus albus	2 moist	Alcohol	Staphylococci	More than 50
Staphylococcus albus	1 moist	Alcohol	Staphylococci	30
Staphylococcus albus	1 moist	None	Staphylococci	More than 50

4. Hatton, E. H.: D. Cosmos, 70:336 (March) 1928.

mentation, a standardized technic for securing culture material has been evolved which we believe reduces the error of contamination to a point where correlation between bacteriologic results and roentgenographic findings in typical fields is practical.

Of the ninety roentgenographically positive teeth, there were seventy-four with growth. Of these, fifty-four were found to have more than fifty colonies. Of the remaining twenty frankly diseased teeth with growth less than fifty colonies, three had one, three and six colonies, respectively, and seventeen gave from twenty to forty colonies in the 48-hour culture. Several of those with slight growth had gross granulomatous tissue, which was not cultured.

Table 2.—Summary of Tooth Cultures

Roentgen-Ray Findings	Number Teeth Cultured	Growth	No Growth	1 to 50 Colonies	More than 50 Colonies
Roentgen-ray positive teeth	90	74	16	20	54
Periapical change	31	16	15	7	9
Roentgen-ray negative teeth	25	3	22	2	1
Vital teeth	34	5	29	3	2
Granuloma	20	20	0	8	12
Total	200	118	82	40	78

Bacterial growth should be expected from practically all such teeth if the roentgenographic changes are of bacterial origin. Prior to this study, a number of bacteria-free cultures have been reported[1] from teeth which showed gross changes in the roentgenogram. In a series of roentgenographically positive teeth cultured in our laboratory by earlier methods, similar bacteria-free cultures were obtained in 23 per cent. Several explanations for this have been advanced, all based upon the belief that these areas were in fact sterile when cultured. Again, in the present study, negative bacteriologic results from apices of grossly roentgenographically positive teeth were obtained. When the granulomas were removed from such areas and cultured *en masse* after surface sterilization as described for the root apices, a luxuriant bacteriologic growth resulted in each instance. It would appear, therefore, that such roentgenographically positive teeth invariably have infection about the apical area, but not always demonstrable by culturing the root apex alone. If confirmed by further study, the results obtained indicate that all such frank bone changes must be looked on as evidence of the presence of viable organisms.

Included in the group of teeth with periapical change are those with any slight divergence from normal. Such changes may be the result of infection, but this is not invariably the case as traumatism or the introduction of irritative medicaments during treatment may cause similar changes. Cultures of such teeth

should show a variable number with bacterial growth, and if our conception of the different causes of bone change about these teeth is correct, some should be bacteriologically negative. It is of interest that, in this group, only about half the teeth cultured showed growth and comparatively few gave more than fifty colonies. From the bacteriologic standpoint, therefore, those teeth showing the roentgen-ray changes described must be regarded as possibly but not necessarily infected. The apices of this group show widely differing types of bone change. It seems possible, therefore, that, with more exhaustive study, further roentgenographic differentiation with regard to the probability of infection may be made.

Cultures of roentgenographically negative teeth should show little bacterial growth, and, in the group studied, only three of twenty-five gave positive cultures. This number, surprisingly small compared with others reported, is undoubtedly the result of narrowing the selection to teeth to those with definitely normal surrounding structures roentgenographically.

In the group of vital teeth were five with growth. Two which had more than fifty colonies were undoubtedly grossly infected.[5] One of these was supporting a long bridge under a gold crown. Traumatism and thermal change may have produced in this tooth a degenerating and infected pulp.[2] The other held a moderately large amalgam filling and showed some interproximal resorption of the alveolar process, which also might have caused pulp infection. Of the other three teeth with growth, two had only one colony each in the 48-hour culture and the remaining tooth only three colonies.

5. Footnote 2. Thoma, K. H.: J. D. Res., 8:529 (Aug.) 1928. Austin, L. T., and Cook, J. J.: Bacteriologic Study of Normal Vital Teeth, J. A. D. A., 16:894 (May) 1929.

CONCLUSIONS

The group of cultures presented here is small in comparison with some others that have been reported, and further study is being conducted at present to lend the weight of numbers to our conclusions. Individual conditions, as shown by the roentgenogram, are well represented and the correlation between these and quantitative bacteriologic studies appears to be definite and significant.

The results thus far would indicate that:

1. Granulomas are invariably infected.
2. Apical areas about roentgenographically positive teeth are probably invariably infected.
3. Teeth with slight periapical change are infected to a less degree than those with more pronounced pathosis, and further classification may be possible.
4. Teeth definitely negative roentgenographically are infected only occasionally.

EFFECTS OF VARIOUS METHODS OF VULCANIZATION ON RUBBER AND A COMPARISON OF VULCANITE WITH OTHER BASE MATERIALS*

By LELAND E. WEYER, D.D.S., New York City

THE object of this paper is to bring to mind the importance of correct methods of vulcanization. Before reporting the results of some experiments carried out, it is necessary to discuss briefly vulcanite and vulcanization. Vulcanite is a compound of pure gum rubber, or caoutchouc, and sulphur. Caoutchouc is the dried milky juice of certain trees found chiefly in the tropics. The trees are tapped and the juice or the latex is taken in clay basins and then solidified by evaporation, which is carried out by the use of heat or acetic or citric acids. A part of the caoutchouc is soluble, a part insoluble. The soluble portion, called polyprene, unites with the sulphur to form vulcanite during the process of vulcanization. In general, dental rubber consists of caoutchouc, sulphur and coloring matter plus certain compounds which are the secret of the manufacturer.

VULCANIZATION

Sulphur is the cooking agent for the rubber. The union of the rubber and the sulphur, which forms vulcanite, is said by some to be chemical; others say it is physical; while still others say that it is a combination of the two. However that may be, vulcanite, once formed, cannot be separated into the substances having the same physical properties as they had before the union. During the process of vulcanization, the polyprene or soluble portion and the sulphur are united either chemically or physically or both to form vulcanite. The insoluble portion of the caoutchouc unites very slowly with the sulphur and forms a small amount of hydrogen sulphid. The process starts when the temperature reaches 248 F., at which time hydrogen sulphid is given off and expansion of the rubber begins. Vulcanite cannot be formed until the case is carried to 280 F. or higher. At 280 F., shrinkage of the rubber begins. The object is to have the same amount of shrinkage as there has been expansion. This requires very careful handling of the vulcanizer.

The amount of pure gum rubber and the amount of sulphur present in the mixture have a bearing on vulcanization. The greater the amount of pure gum rubber present in the mixture, the greater the amount of sulphur that will be required to vulcanize it. Before vulcanization, sulphur and caoutchouc are present as a mechanical mixture; during the process, the sulphur and rubber combine owing to the heat. If there is not enough sulphur present in the mixture to complete the process, the result will be rubber resembling rubber tubing. Rubber tubing is made from rubber having only 10 per cent sulphur present in the mixture, and the temperature from 250 to

*Read before the Section on Full Denture Prosthesis at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 22, 1931.

TABLE 1.—POROSITY

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Composition per 16-ounce mixture: Pure gum rubber and sulphur	9.7 oz.	10.7 oz.	8 oz.	9 oz.	8.5 oz.	9 oz.	4 oz.	4.8 oz.
Composition per 16-ounce mixture: Color and compound	6.3 oz.	5.3 oz.	8 oz.	7 oz.	7.5 oz.	7 oz.	12 oz.	8 oz. col. 3.2 cmpd.
Series 1: Run up in 10 min. to 290° F. and held for 2¼ hr. in water.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 2: Run up in 10 min. to 290° F. and held for 2¼ hr. in steam.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 3: Run up in 40 min. to 300° F. and held for 1½ hr. in water.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 4: Run up in 40 min. to 300° F. and held for 1½ hr. in steam.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 5: Run up in 10 min. to 280° F. and held for 45 min.; then run up to 305° F. and held 2¼ hr. in water.	Few pores	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 6: Run up in 10 min. to 280° F. and held 45 min.; then run up to 305° F. and held for 2¼ hr. in steam.	Porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 7: Run up in 25 min. to 320° F. and held for 55 min. in water.	Very porous	Very porous	Porous	Porous	Few pores	Porous	Non-porous	Non-porous
Series 8: Run up in 25 min. to 320° F. and held for 55 min. in steam.	Very porous	Porous	Porous	Porous	Porous	Porous	Non-porous	Non-porous
Series 9: Run up in 10 min. to 290° F. and held for 2¼ hr. in water.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 10: Run up in 10 min. to 290° F. and held for 2¼ hr. in steam.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous

Series 11: Run up in 40 min. to 300° F. and held for 1½ hr. in water.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 12: Run up in 40 min. to 300° F. and held for 1½ hr. in steam.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Nno-porous
Series 13: Run up in 10 min. to 280° F. and held 45 min.; then run up to 305° F. and held 2½ hr. in water.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 14: Run up in 10 min. to 280° F. and held 45 min.; then run up to 305° F. and held for 2½ hr. in steam.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 15: Run up in 25 min. to 320° F. and held for 55 min. in water.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous
Series 16: Run up in 25 min. to 320° F. and held for 55 min. in steam.	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous	Non-porous

270 F. is held for approximately twenty-five minutes. Usually, the dental rubbers are 25 per cent sulphur and the temperature must be above 280 degrees before vulcanite for dental purposes can be produced.

Coloring matter and compounds present in the mixture have a bearing on the quality of vulcanite produced and to some extent affect the time and temperature of vulcanization. Vermilion or mercurial sulphid is one of the common coloring materials used in dental rubbers. Various shades are obtained by the use of dark colored vermilion or are modified by the use of lamp black or other pigments. Metallic coloring materials only can be used in dental rubbers as the anilin and vegetable colorings are burnt out in the process of vulcanization. In certain rubbers, metals such as aluminium are used and zinc oxid, with only enough raw as a coloring material. In pink rubbers, the principal constituents are vermilion rubber present to hold the ingredients together. Introduction of coloring matter into a rubber will make the vulcanite weaker, but it will show less shrinkage, and it will not become porous so easily as the purer compounds. More heat may be used in the vulcanization when there is a large amount of coloring material present in the mixture, but the vulcanite will be weaker.

Varying degrees of porosity. Left to right: no porosity; few pores; porous; very porous.

Temperature and the length of time of vulcanization have a bearing on the

TABLE 2.—STRENGTH

Series*	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
	9.7 oz.†	10.7 oz.†	8 oz.†	9 oz.†	8.5 oz.†	9 oz.†	4 oz.†	4.8 oz.†
	6.3 oz.‡	5.3 oz.‡	8 oz.‡	7 oz.‡	7.5 oz.	7 oz.‡	12 oz.‡	8 oz. col. 3.2 cmpd.
1	X§	X	Soft	X	X	X	Weak	Weak
2	Soft	Soft	Soft	Soft	Soft	Soft	Fairly hard	Fairly hard
3	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Strong	Strong
4	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong
5	Weak	Very hard and strong	Very hard and strong	Very hard and strong	Very hard and strong	Very hard and strong	Strong	Strong
6	Weak	Very hard and strong	Very hard and strong	Very hard and strong	Very hard and strong	Very hard and strong	Strong	Strong
7	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
8	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
9	X	X	Soft	X	X	X	Fairly hard	Fairly hard
10	Soft	Soft	Soft	Soft	Soft	Soft	Fairly hard	Fairly hard
11	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Strong	Strong
12	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Hard, strong	Strong	Strong
13	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong
14	Strong	Strong	Strong	Strong	Strong	Strong	Strong	Strong
15	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
16	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak

*For time and temperature employed in each series, compare Table 1.

†Content per 16-ounce mixture of pure gum rubber and sulphur.

‡Content per 16-ounce mixture of color and compound.

§Indicates that rubber was not completely vulcanized.

quality of vulcanite produced. As plaster-of-Paris is a poor conductor of heat, it takes considerable time for the heat to penetrate a flasked case in the vulcanizer. If the temperature is raised rapidly, heat will not penetrate the case entirely before vulcanization starts on the surface of the rubber, and this seals the gas in the center of the case, porosity resulting. If the temperature is run up slowly, the heat bearing on the temperature of vulcanization that should be used and on the duration of the process. For example, a piece of rubber one-tenth inch thick can be vulcanized rapidly, while a piece three-sixteenths inch thick will require more time. If in the vulcanizing of a thick piece of rubber the temperature has been run up quickly to a high point, a porous condition of the interior of the case results.

TABLE 3.—FLEXIBILITY AND ELASTICITY

Series*	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
	9.7 oz.†	10.7 oz.†	8 oz.†	9 oz.†	8.5 oz.†	9 oz.†	4 oz.†	4.8 oz.†
	6.3 oz.‡	5.3 oz.‡	8 oz.‡	7 oz.‡	7.5 oz.‡	7 oz.‡	12 oz.‡	8 oz. col. 3.2 cmpd.
9	Very elastic	Very elastic	Elastic	Very elastic	Very elastic	Very elastic	Flexible	Flexible
10	Elastic	Elastic	Flexible	Elastic	Elastic	Elastic	Flexible	Flexible
11	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Rigid	Rigid
12	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Rigid	Rigid
13	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid	Brittle	Brittle
14	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid	Brittle	Brittle
15	Brittle	Brittle	Brittle	Brittle	Brittle	Brittle	Very brittle	Very brittle
16	Very brittle	Very brittle	Very brittle	Very brittle	Very brittle	Very brittle	Very brittle	Very brittle

*The samples of series 1-8 were of too great a thickness to be tested for flexibility and elasticity by comparison with the other samples. For time and temperature employed in each series, compare Table 1.

†Content per 16-ounce mixture of pure gum rubber and sulphur.

‡Content per 16-ounce mixture of color and compound.

being allowed to penetrate the case thoroughly before the temperature of vulcanization is reached, the gases will escape and a good, dense vulcanite will be produced.

Rubber is also a poor conductor of heat, and the thickness of the case has a The outside of the vulcanite appears hard and well vulcanized. When the piece is sectioned, it consists of the hard outer shell, and a porous interior, and the odor of hydrogen sulphid is present. Some of the samples in a series show a marked degree of porosity, while others

show only a few pores. It will be noted that porosity is present only in the samples that were heated quickly and vulcanized at a high temperature, with one exception. The porosity in this case was probably due to the composition of this particular rubber. Porosity can be handled by the proper management of the vulcanizer. When thick dentures are to be vulcanized, and when mixtures of almost pure gum rubber and sulphur are used, the temperature must be allowed to rise gradually after it has reached 250 F., and it must not be allowed to exceed

TABLE 4.—EXPANSION AND SHRINKAGE

Series*	Sample 1 9.7 oz.† 6.3 oz.‡	Sample 2 10.7 oz.† 5.3 oz.‡	Sample 3 8 oz.† 8 oz.‡	Sample 4 9 oz.† 7 oz.‡	Sample 5 8.5 oz.† 7.5 oz.‡	Sample 6 9 oz.† 7 oz.‡	Sample 7 4 oz.† 12 oz.‡	Sample 8 4.8 oz.† 8 oz. col 3.2 cmpd.
1	C§	C	C	C	C	C	X	X
2	C	C	C	C	C	C	X	X
3	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X
5	B	X	X	X	X	X	X	X
6	A	X	X	X	X	X	X	X
7	E	E	A	A	B	A	X	X
8	E	A	A	A	A	A	X	X
9	C	C	C	C	C	C	X	X
10	C	C	C	C	C	C	X	X
11	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X	X

*For time and temperature employed in each series, compare Table 1.

†Content per 16-ounce mixture of pure gum rubber and sulphur.

‡Content per 16-ounce mixture of color and compound.

§A indicates expansion; B, small amount of expansion; C, shrinkage; E, great amount of expansion; X, practically no expansion nor shrinkage.

TABLE 5.—POLISH

Series*	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
	9.7 oz.†	10.7 oz.†	8 oz.†	9 oz.†	8.5 oz.†	9 oz.†	4 oz.†	4.8 oz.†
	6.3 oz.‡	5.3 oz.‡	8 oz.‡	7 oz.‡	7.5 oz.‡	7 oz.‡	12 oz.‡	8 oz. co.l 3.2 cmpd.
1	X§	X	Fair gloss	X	X	X	Fair gloss	Fair gloss
2	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss
3	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss
4	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss
5	Y	Very high gloss	Very high gloss	Very high gloss	Very high gloss	Very high gloss	High gloss	High gloss
6	Y	Very high gloss	Very high gloss	Very high gloss	Very high gloss	Very high gloss	High gloss	High gloss
7	Y	Y	Y	Y	Y	Y	Fair gloss	Fair gloss
8	Y	Y	Y	Y	Y	Y	Fair gloss	Fair gloss
9	X	X	Fair gloss	X	X	X	Fair gloss	Fair gloss
10	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss
11	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss
12	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss
13	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss
14	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss	High gloss
15	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss
16	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss	Fair gloss

*For time and temperature employed in each series, compare Table 1.

†Content per 16-ounce mixture of pure gum rubber and sulphur.

‡Content per 16-ounce mixture of color and compound.

§Indicates samples not polished because they were not completely vulcanized; Y, samples not published because of the porosity of the sample.

305 F. if nonporous vulcanite is to be produced.

The amount of pressure applied on the rubber has a bearing on the kind of vulcanite produced. It determines to some extent whether the denture will be porous. If the case is a little underpacked, too little pressure is exerted and porosity will result. If the case is overpacked, too much pressure is applied and the plaster may be distorted.

To summarize: The factors in vulcanization to be considered are: (1) the amount of pure gum rubber and sulphur present in the mixture; (2) the composition of the rubber as to coloring matter and compounds; (3) the temperature at vulcanization; (4) the length of time of vulcanization; (5) the thickness of the case; (6) the pressure applied on the rubber.

REPORT ON EXPERIMENTS

The objectives in carrying out these experiments were as follows:

1. To determine at what time and temperature the best quality vulcanite can be produced. As regards quality, the following points were considered: (*a*) porosity, (*b*) strength, (*c*) flexibility and elasticity, (*d*) expansion and shrinkage and (*e*) polish.

2. To determine whether the composition of the various rubbers used had any effect on the vulcanite.

3. To determine differences in vulcanite when steam was used and when water was used.

4. To gain some information as to the vulcanization of dentures varying in size and thickness.

In conducting this experiment, eight popular brands of dental rubbers were used, the rubber being obtained on the open market. Sixteen series of rubbers consisting of the eight samples each were vulcanized. The samples of series 1-8 inclusive were three-eighths inch thick, three-quarters inch wide and one and three-eighths inches long. The samples of series 9-16 inclusive were one-tenth inch thick, three-fourths inch wide and two inches long. Wax blocks of the foregoing dimensions were prepared. Each block of wax was flasked separately in plaster-of-Paris. The flasks were separated and the wax was removed in the usual manner. Each case was carefully packed and tested to ensure that there was exactly the right amount of rubber in each case. After all of the samples were vulcanized, roentgenograms were made to determine porosity. Tests for the other properties of the vulcanite were made by comparison of the samples with each other, and the results recorded on charts. The samples of series of 1-8 inclusive were also sectioned with a saw so that the interior of the case could be examined.

The time of and temperature at vulcanization of the samples are given in Table 1.

Composition of the Samples Tested.—Sample 1 contained 9.7 ounces of pure gum rubber and sulphur, and 6.3 ounces of color and compound per 16-ounce mixture.

Sample 2 contained 10.7 ounces of pure gum rubber and sulphur, and 5.3 ounces of aluminium and compound per 16-ounce mixture. The aluminium in this case gives the rubber its color.

Sample 3 contained 8 ounces of pure gum rubber and sulphur, and 8 ounces of vermilion and compound per 16-ounce mixture.

Sample 4 contained 9 ounces of pure gum rubber and sulphur, and 7 ounces of vermilion and other coloring matter and compounds per 16-ounce mixture.

Sample 5 contained 8.5 ounces of pure gum rubber and sulphur, and 7.5 ounces

of coloring matter and compound per 16-ounce mixture.

Sample 6 contained 9 ounces of pure gum rubber and sulphur, and 7 ounces of vermilion and compound per 16-ounce mixture.

Sample 7 contained 4 ounces of pure gum rubber and sulphur, and 12 ounces of vermilion, zinc sulphid and compounds per 16-ounce mixture.

Sample 8 contained 4.8 ounces of pure gum rubber and sulphur, 8 ounces of coloring matter, and 3.2 ounces of compound per 16-ounce mixture. Several different shades are blended in the manufacture of this rubber.

The results of the experiment are shown in the accompanying tables.

Porosity is present in the first sample of both series 5 and 6, and in all of the samples of both series 7 and 8 except samples 7 and 8, which are the pink rubbers. It is my opinion that the porosity in the first sample of series 5 and 6 is due to the composition of the rubber. The porosity in series 7 and 8 is due to the temperature's being carried up too rapidly, with vulcanization at too high a temperature. The pink rubbers show no porosity because pure gum rubber is present in the mixture only in a small amount. (Table 1.)

The strength of vulcanite depends on the amount of pure gum rubber present in the mixture with exactly enough sulphur to vulcanize it. As a rule, the greater the amount of pure gum rubber present, the greater the strength of the vulcanite, if the case is properly vulcanized. Vulcanization must be carried on for a longer period of time at a lower temperature. Samples of series 5 and 6, with the exception of sample 1 of each series, and samples of series 13 and 14 show the greatest strength. Samples of series 3, 4, 11 and 12 are also strong. (Table 2.)

There is a marked difference in the quality of the vulcanite produced at various temperatures. If a piece of rubber does not exceed one-tenth inch in thickness, the temperature can be run up more rapidly, the rubber can be vulcanized at a higher temperature and no porosity will result; but it loses its flexibility and elasticity and is very brittle. Samples of series 9 and 10, with the exception of samples 7 and 8 of each series, are too elastic to be of value. Samples of series 11 and 12 are flexible and tough, which makes them desirable. Samples of series 13 and 14 are rigid, and samples of series 15 and 16 are brittle. (Table 3.) The elasticity and flexibility of vulcanite are caused by vulcanizing at a lower temperature over a longer period of time. The brittleness is caused by running the temperature up quickly to the vulcanization point and vulcanizing at a high temperature. It may be caused by having an excess amount of sulphur in the mixture.

The greatest amount of expansion is found in samples of series 7 and 8 except the samples of pink rubber. Sample 1 of series 5 and 6 shows some expansion. Expansion is caused by bringing the temperature up too rapidly to the vulcanization point and vulcanizing at a high temperature. Expansion takes place until vulcanization begins and then shrinkage takes place. If the temperature is brought up rapidly to a high point, vulcanization begins on the surface, the gasses are trapped on the inside, the proper amount of shrinkage cannot take place and the vulcanized denture shows expansion. Shrinkage is present in samples of series 1, 2, 9 and 10. This shrinkage was caused by vulcanizing for too long a time at too low a temperature. (Table 4.)

Samples of series 5 and 6 were the

most difficult to polish. The samples being very hard and dense, the scratches were harder to remove, and a high gloss was obtained after a great deal of polishing. The polish will be retained for a longer period of time than that which was obtained more easily. (Table 5.)

Before I give my conclusions about vulcanite and vulcanization, I should like to compare it with other base materials.

The ideal denture base should possess the following qualities: It should (1) be dense and strong; (2) be nonporous; (3) have a small amount of expansion and shrinkage; (4) inhibit bacterial growth; (5) be odorless and tasteless; (6) harmonize in color with the tissues of the mouth; (7) not change form under the stress of mastication; (8) be a good conductor; (9) adapt itself to a cast made from an impression of the mouth; (10) not be affected by the secretions of the mouth or by foods taken into the mouth; (11) be hard, so that it will take a good polish and keep this polish for a long period of time, and (12) be easy to repair.

CELLULAR OR CELLULOSE MATERIALS

Most celluloid or cellulose materials are synthetic substances which consist of the following: (1) Pyroxylin, woody fibers treated with acetic acid; which gives acetocellulose; (2) synthetic camphor (coal-tar product), and (3) coloring materials.

As these materials are less dense and more porous than vulcanite, the amount of expansion and shrinkage is small. They do not inhibit bacterial growth and are not odorless and tasteless. In certain cases, they change form under the stress of mastication. The color is very similar to that of the tissues in the mouth, these materials being more desirable than vulcanite in this respect. They, like vulcanite, are poor conductors of heat and cold. They are fairly easy to manipulate and readily adapt themselves to a cast of the mouth. In some cases, they are affected by the secretions in the mouth and by certain foods or liquids taken into the mouth. They take a good polish, but stain very easily. As a rule, they are easy to repair.

CONDENSITES OR PHENOL RESINS

Condensites or phenol resins are derivatives of phenol-formaldehyd plus certain catalytic materials to anneal them. In the past, these materials have not been strong, but, in most cases, this feature has been remedied to a great extent. Like vulcanite, these materials are nonporous, and they have a small amount of expansion and shrinkage. They do not inhibit bacterial growth to any great extent. The condensites are practically odorless and tasteless, and they harmonize in color with the tissues in the mouth. They do not change form under the stress of mastication and are good conductors. Condensites are hard to manipulate, and it is rather difficult to adapt them to a cast of the mouth. They are unaffected by the secretions of the mouth and will take a high polish and maintain it for a long period of time. These materials do not stain so readily as the cellulose materials, but are difficult to repair in most cases.

METAL BASES

In general, metal bases are very strong, and nonporous. If the bases are swaged, there will be no expansion or shrinkage; but, if cast, there is apt to be expansion or shrinkage. It is said that metal bases inhibit bacterial growth. They are not altogether odorless and tasteless, some patients complaining of the metallic taste. These materials are good conductors. Metals are hard to manipulate to adapt

to a cast of the mouth. They are unaffected by secretions in the mouth. They take a high polish and maintain it for a long period of time. Metal bases are difficult to repair.

VULCANITE

Vulcanite, when properly vulcanized, possesses a great many of the desirable qualities for a denture base, although it is not ideal. It is dense and strong, and is nonporous if the case has been properly handled in the vulcanizer. It shows some expansion and shrinkage, but this can be controlled by the careful manipulation of the vulcanizer. Vulcanite does not inhibit bacterial growth. It is not altogether odorless and tasteless, but this can be controlled largely by good care of the denture by the wearer. Pink rubber does not harmonize perfectly with the color of the tissues in the mouth, but if the shades are carefully selected, satisfactory results will be obtained. When properly vulcanized and polished, it is not affected to a great extent by secretions in the mouth. It will take a high polish and keep it for a long period of time. It is very easy to repair.

From the experiments which have been presented in this paper, the following conclusions about vulcanite and its vulcanization have been drawn:

1. It is more difficult to vulcanize without porosity when there is a greater amount of pure gum rubber present in the mixture. For example, it is easy to vulcanize pink rubber because there is merely enough pure gum rubber present to hold the ingredients together. Porosity can be handled by the proper management of the vulcanizer.

2. The purer mixtures of pure gum rubber and sulphur produce the maximum strength of vulcanite if the case is properly vulcanized. A longer period of vulcanization at a lower temperature is required to give greater strength.

3. Vulcanite produced at a lower temperature over a longer period of time is much more flexible and elastic, while the vulcanite produced at a high temperature over a short period of time is brittle.

4. Expansion is caused by running the temperature up too rapidly to the vulcanization point and vulcanizing at too high a temperature. Shrinkage is caused by vulcanizing for too long a period of time at a low temperature.

5. The hard dense vulcanite produced by the longer period of vulcanization is more difficult to polish than the softer vulcanite, but, once polished, it will retain its polish for a longer period of time.

6. Introduction of coloring matter and compound into the rubber makes the vulcanite weaker, but it shows less shrinkage and less porosity, and it can be vulcanized at a higher temperature for a shorter period of time. The composition of the mixture therefore has a direct bearing upon the time and temperature of vulcanization.

7. Vulcanite produced in steam and in water does not differ to a great extent except in the dentures vulcanized at 290 and at 320 F. The samples of series 2, except samples 7 and 8, are more completely vulcanized than the samples of series 1. The samples of series 10, except samples 7 and 8, are more completely vulcanized than the samples of series 9. The samples of series 16, except samples 7 and 8, are more brittle than the samples of series 15.

8. The preferable time for vulcanization of the thick cases considering all of the factors is as follows: Run up in ten minutes to 280 F. and hold for forty-five minutes; then run up to 305 F. and hold for two hours and thirty minutes.

The best quality vulcanite was produced in this time and at this temperature.

9. For vulcanization of the thin dentures considering all of the factors, it is preferable to run up the temperature in forty minutes to 300 F. and hold for one hour and thirty minutes. The best quality vulcanite was produced in this time and at this temperature.

10. It is of great importance to know the composition of the rubber as to the amount of pure gum rubber, color, compound, etc. This factor, together with the thickness of the denture, determines the correct temperature of vulcanization, and the length of time of vulcanization in the particular case to produce the best possible quality of vulcanite.

I have made an effort to bring to mind some of the important points about rubber and its vulcanization. I believe that this material has been greatly abused through the years, but, from every standpoint, it still stands out as possibly the best material that we have today.

U. S. Marine Hospital, 67 Hudson Street.

DISCUSSION

W. J. Pryor, Cleveland, Ohio: A study of Dr. Weyer's excellent paper reveals that his work corroborates that of the old masters, George B. Snow, George Wilson and others. The results of all of these researches again repeated and brought to our attention should stimulate each one of us to check up carefully as to the manner in which our dentures are vulcanized. These old truths tell us that the vulcanizer must be heated slowly enough from 250 F. to the vulcanizing point chosen, to allow for the escape of gases generated, or the case will be porous; that thick dentures and rubbers containing little coloring matter or other fillers require particular care, more time and lower heat; that even if the denture is not porous, brief vulcanization at too high a temperature will produce a brittle base. The shortest vulcanizing time possible to secure a hard strong resilient base should be used. Dr. Weyer points the way in experiments 11 and 12, where he uses both medium heat and time. Filling in thick dentures generously with a good pink rubber is a very practical method of preventing both porosity and shrinkage. Too long a vulcanization at low heat will cause shrinkage, which will manifest itself more unfavorably in a denture than in an experimental strip of vulcanite. The material may draw away from the teeth or cause a defective fit, evidenced by a binding on the buccal side of the tuberosities and a loss of adaptation on the lingual side. Deterioration of casts and investments by too long an exposure to the steam heat also contribute to a faulty fitting denture. The technic of holding the flask in spring pressure should be followed to allow for expansion and to follow up the contraction. The whole system of recording and writing about vulcanizing temperatures is wrong and is very confusing. It should be changed, as the actual temperature inside the vulcanizer is almost 20 degrees higher than that indicated on the thermometer and gas regulator. In recent correspondence, Mr. John H. Lewis, of the Buffalo Dental Mfg. Co., says, "The story of this error goes back over fifty years, but as all American manufacturers in developing dental vulcanite used our vulcanizers and thermometers and published their instructions accordingly, we have found it wise to continue to build all of our machines with this same inaccuracy of temperature reading." Most cases are therefore vulcanized at 337 to 340 F. and not at 320 F., and all of Dr. Weyer's charts should be scaled accordingly. While vulcanite dentures have been a godsend to both patient and dentist and will continue to be for many years to come, progressive men must be alert and not overlook improved materials when they have proved their merit. The advantages of vulcanite are its lightness, cheapness and durability. In case of repair, let us match with these its disadvantages: It is a poor conductor and an excellent incubator for bacterial growth, the products of which may lower the vitality of the soft tissues and lead to absorption of the hard underlying structures. It shows shrinkage under vulcanization, becoming more brittle and shrinking further at each repair. In esthetic effect, it rates low. Esthetics is by far the most important consideration in the minds of the vast majority of patients of the middle and upper class practice. I have for years chafed under the enforced use of vulcanite because of its unsightly appearance in many cases. The improved cellulose materials and

synthetic resins have a tremendous advantage over vulcanite in this respect. The synthetic resins at their best are the peer of all dentures as regards appearance; the color is as yet not always constant nor permanent. These materials are dense, but not so strong, nor so easily repaired or constructed as vulcanite or the pyroxylins. The better cellulose materials far surpass vulcanite in appearance. They make light, resilient bases, tougher than vulcanite. They are more easily repaired than any denture and lend themselves to minor refitting or adjustments while the patient waits. They may not remain in service so long as vulcanite, but can easily be duplicated or reset. By the use of strong stone casts and investing material, which is exposed to dry heat and fairly high pressure for only a short time (one-half hour) in an electrically heated hydraulic press, a very satisfactory cellulose denture can be made. The casts and investment come through this process very hard and their removal from the flask is no easy matter. Properly aged cellulose blanks pressed in this manner produce dentures which show less shrinkage than vulcanite. They are not porous and do not stain more readily than vulcanite and the condensites that I have worked with. With several hundred cases under observation, I have yet to find one that changes form under masticating stress. They will change form if left to dry out in the air, especially when new, and when the blanks they are made from are not properly aged. If they are kept wet and away from heat, this trouble can be avoided. The properly constructed swaged metal base, where indicated, with cellulose, condensite or vulcanite gum to suit the case at hand, is the most satisfactory of all dentures in my practice. It is the only base which will seat back exactly on a technic model, where an impression is made from this model instead of being made from the mouth. It also has no competitors in the matter of conductivity, thinness, etc. I know of no case in which the taste of the material itself is a source of annoyance to the patient after the first few days of wearing.

NUPERCAIN, A LOCAL ANESTHETIC: PRELIMINARY REPORT

By C. C. WAHL, D.D.S., San Francisco, Calif.

THE local anesthetic properties of quinin have been known for many years, and its prolonged action is very desirable. The chief undesirable property is tissue irritation.[1] As a result of efforts to develop a local anesthetic from the quinin series, nupercain was synthesized by Meischer and introduced by Uhlmann, in 1929.[2]

The crystals are colorless, odorless and tasteless, and are readily soluble in water. The solution can be boiled, but in contact with the least alkali, dangerous decomposition products are formed and therefore all solutions of nupercain should contain a trace of acid.[3]

The efficiency of nupercain has been reported as roughly ten times that of co-

*From the Pharmacological Laboratory of the University of California Medical School, San Francisco.

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3. Keyes, E. L., and McClellan, A. M.: Am. J. Surg., 9:1 (July) 1930. Jones, W. H.: Brit. J. Anes., 7:146 (July) 1930; Cur. Res. Anes. & Anal., 9:218 (Sept. Oct.) 1930.

cain, and about forty times that of procain when tested on isolated nerve tissue.[4] It is an effective topical anesthetic, but penetration is very slow. When a solution is injected, it takes much longer than procain to take effect.[5] The anesthesia produced lasts from four to twelve hours.[6]

The toxicity of nupercain has been variously reported as five to twelve times that of cocain.[7] As has been reported for other local anesthetics,[8] cerebral depressants offer considerable protection for subcutaneous injections, but not for intravenous injections.[9]

In Europe, nupercain was recommended for clinical use soon after its discovery; and some unfavorable results, such as toxic symptoms and tissue necrosis, and even a number of deaths, have been reported.[10]

In general surgery, especially spinal anesthesia, nupercain has distinct value: a small amount can be injected, and anesthesia lasts long enough to give ample time for the operation. It has been used very successfully for that purpose in hundreds of cases.[11]

In dental surgery, nupercain has not been found satisfactory.[12] Poor penetration eliminates it as a topical anesthetic. It requires more time than does procain to take effect. Diffusion is very slow, and therefore any injection must be made into, or at least very close to, the nerve.[13] Such a drug cannot be used for infiltration anesthesia, and could be used only by the most expert for dental nerve blocking.

A mixture of nupercain and procain has been advocated.[14] This cannot be approved until a thorough study of the chemical reaction has been made and further research has been done. On the basis of the experimental and clinical evidence thus far obtained, nupercain cannot be recommended for general use in dental surgery.

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A NEW ORTHODONTIC MECHANISM: THE TWIN WIRE AUTOMATIC APPLIANCE*

By JOSEPH E. JOHNSON, D.D.S., F.A.C.D., Louisville, Ky.

FOR a great many years, I have been predetermining tooth movement with amalgam models by the method shown in Figure 1 and described before this association in 1925. Of the many facts which I have learned about the moving of teeth in this way, none have struck me more forcibly than that of the small amount of tooth movement necessary to correct the average case of malocclusion and the necessity of getting bodily movement of the anterior teeth.

On numerous occasions, I have thought how gratifying it would be to have an appliance to move the teeth automatically to their normal positions —an appliance that would move not only the crowns of the teeth but also the roots.

After several years of experimenting, I have finally designed the twin wire alinement arch, which accomplishes the foregoing object very satisfactorily. It is simple in construction and is more easily operated than the old alinement arch.

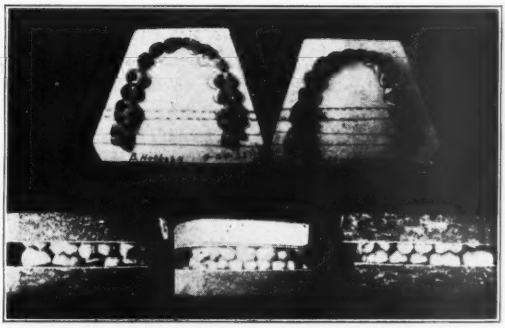

Fig. 1.—Author's method of predetermining tooth movement with amalgam models.

The twin wire alinement arch is composed of two small hard stainless steel wires, ranging in size from 0.009 to 0.014 inch in diameter. These wires are passed through end tubes as will be noted in Figure 2*A*. The double end of the twin wire is drawn into the end tube as in Figure 2*D*. The opposite end is put through the remaining end tube (Fig. 2*C*), and cut off to the required length. The end is then crimped as shown in Figure 2, *E* and *F*, and the wire then drawn back into the end tube. Thus,

*Read before the Section on Orthodontia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 21, 1931.

the twin wires are held in the tubes by means of friction. *G, H* and *I* are cross-sections of different shaped end tubes. *H* is stronger than either *G* or *I* because the walls of the tubing are thicker. These end tubes have an outside diameter of 0.040 inch. They are made an inch long and can be cut into proper lengths to fit each case.

The important advantages of two small wires over one heavy wire are these:

1. A small wire is more resilient than a large wire. By using an extremely small wire, we get the resiliency

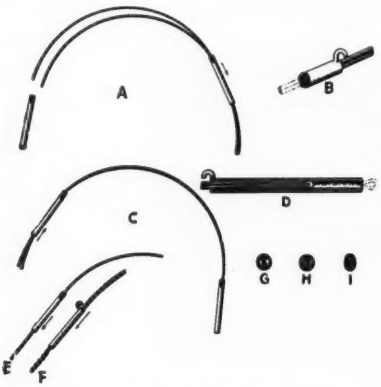

Fig. 2.—Twin wire alinement arch, composed of two stainless steel wires drawn into end tubes.

required to cause the arch wire to spring back into its original shape when forced into the locks. As a single wire with enough resiliency to spring back to its normal shape would not exert enough pressure to move the teeth, the required amount of force to move the teeth and sufficient resiliency for the small wire to return to its former shape is obtained by doubling the wire. Thus, when the twin arch wire is bent into the shape of a normal dental arch, and then sprung into the locks on the teeth, the teeth automatically move into the position of a normal arch.

2. The twin arch wires move the teeth bodily when fastened to them by means of a locking device, and this cannot be done with the use of a single round wire.

As this type of arch has been found to be worthless if ligated to the teeth by means of wire or grass ligatures, a locking device has been designed (Fig. 3) composed of two parts, male and female. The male part is welded to the band. It has parallel walls forming a channel in which the twin wires are seated. The outside wall is dovetailed. The female part, which slips over the male and fits very accurately, is held in place by friction. The locks are made in two sizes, one to fit a double 0.014 inch wire and the other to fit a double 0.010 inch wire. The locks are one-eighth inch long, one-sixteenth inch wide and one-thirty-second inch thick. They come brazed to the bands, which are made with a loop similar to my loop molar band, as is seen in Figure 4. The loops permit a quick and accurate fitting of the bands. It has been found that four sizes of loop bands will fit all anterior and bicuspid teeth. This eliminates the necessity of carrying a large assortment of bands in stock. The bands are so fitted that the locks are at right angles to the long axis of the teeth and should be so placed on them that, when the case is finished, the locks will all lie in the same plane.

Two pliers are necessary to manipulate the appliance. Pliers *D* and *E*, Figure 5, are used to seat the twin wires in the channel. The *E* plier is used to pick up the female part and start it over the male part as shown in *C*, Figure 5. The *E* plier has a stop which permits a slight tightening of the female lock. The *D*

plier is used to complete the seating. As you will note, it has two grooves in the end, one for the upper and the other for the lower teeth. The twin alinement arch fits into these grooves, and when the beaks of the pliers are closed, the female lock is forced over the male part, pliers are used to manipulate the end tubing.

With this twin wire appliance, we automatically move the crowns and roots of the teeth labially, bucally, lingually, mesially, distally, dorsally, occlusally or gingivally. Figures 6 and 7, the labial

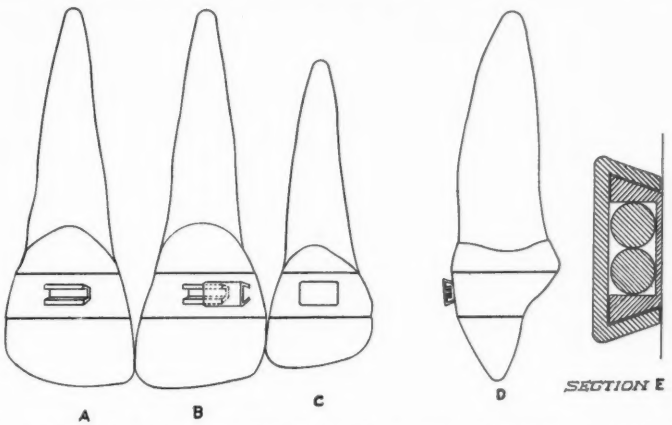

Fig. 3.—Lock used to fasten twin wires to band. *A*, male part which comes brazed to the band. *B*, female part is slipped over male part. *C*, lock in place. *D*, a side view of the lock *E*, cross-section.

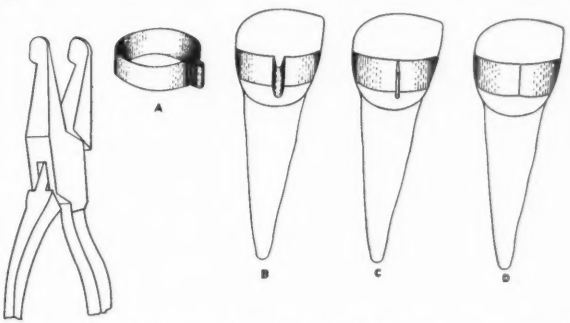

Fig. 4.—Band to which lock is brazed, showing loop similar to that of loop molar band. The loop is pinched on the lingual aspect.

as in *A*, Figure 5. To remove the lock, the process is reversed. Figure 5, *B* is a cross-section showing how the grooves fit over the twin wires. The *F* plier has an 18-gage groove in the beaks. These and incisal views of the appliance, illustrate the way in which these movements are obtained. For example, we will let the dotted lines represent the twin wire alinement arch as it lies passively against

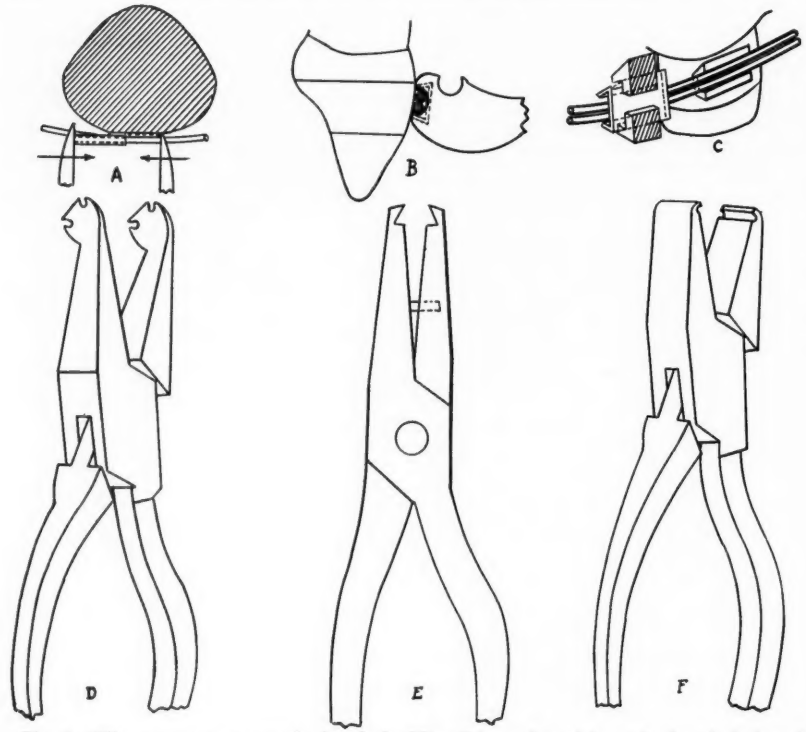

Fig. 5.—Pliers necessary to manipulate lock. Plier *E* is used to pick up the female lock and start it over the male part. *D* is used to complete the seating of the lock. Plier *F*, which has a 17-gage groove in the beaks, is used to manipulate the end tubing.

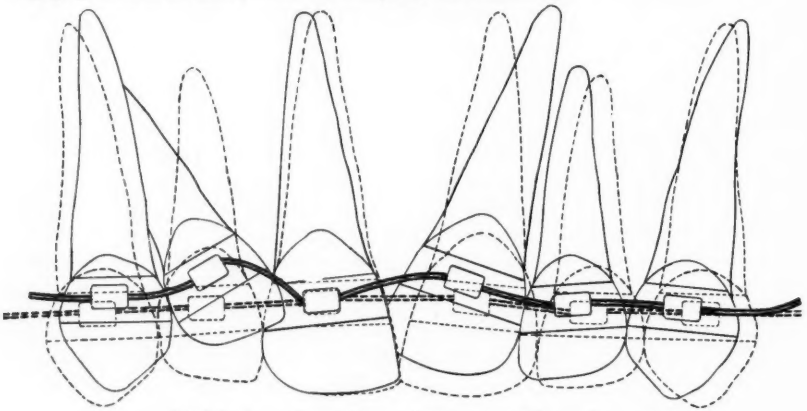

Fig. 6.—Labial view of appliance, showing possible tooth movements.

the teeth. When it is sprung into position on the malposed teeth and locked, the resiliency is so great that the teeth will be moved automatically to the place where the wire originally rested. In this manner, the teeth are carried to their normal positions as represented by the dotted outlines of the teeth. You will note that not only the crowns but also the roots are moved.

Figure 7 is the incisal view of the malposed teeth shown in Figure 6. You will readily see that when the twin wires, represented by the dotted line, are sprung down and locked to the teeth, the malposed teeth will be rotated into position, if the wire has enough resiliency. I might mention here that, although the wires fit accurately in the channel of the lock, there is enough play to allow the tooth to slide along the wires mesially or distally. This is necessary in order to gain room to rotate a tooth. If this sliding is not desired, a drop of cement is put in the female part before it is slipped over the male. This is very important, as frequently, when we are moving the anterior teeth labially, they will slide along the wire and become separated. It is also necessary to cement the locks if we wish to regain a space, as in the case of an impacted cuspid.

I frequently start a case with a 0.010 inch twin wire using the 0.014 inch locks. This allows quite a bit of play in the locks and does not move the tooth so rapidly at the beginning. This method is more desirable in that it does not hold the teeth so rigidly against the wires, thus avoiding the rigidity of the ribbon arch or similar types of appliances. After the initial twin wire has been worn for two or three months, I change to a 0.012 inch or a 0.014 inch, which will complete the bodily movement of the teeth.

If a decided tipping forward of the apical ends of the teeth is desired, the top strand of the twin wire is made

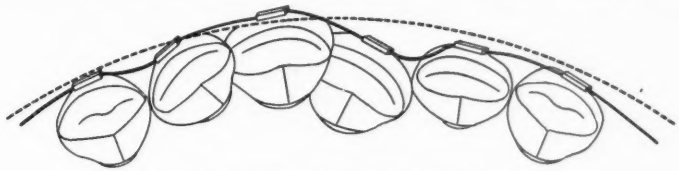

Fig. 7.—Incisal view of appliance shown in Figure 6.

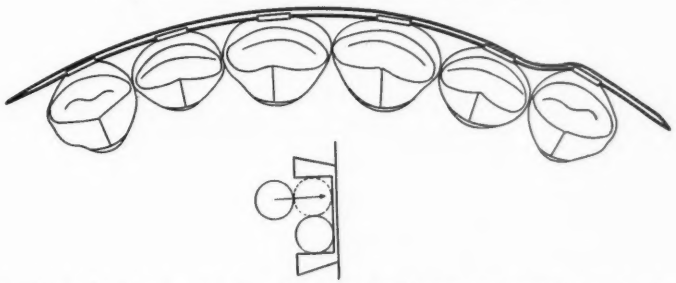

Fig. 8.—Method of tipping apical ends of teeth by having one strand of twin wire longer than the other.

longer, as in Figure 8, in order that, when the lower strand is seated in the lock, the upper strand will stand away from it, as in Figure 8, *B*. If the top strand is forced into position, it will naturally exert more force on the teeth than the lower, causing the apical ends to move forward more rapidly than the crowns.

I do not advocate the use of this appliance to widen the arch in the bicuspid and molar region as I believe that the desired widening can be secured much more easily and surely with a lingual appliance. In a few cases, when the cuspid and bicuspid crowns are tipped forward, as in Figure 9, the apices of the teeth can be tipped forward very readily and the teeth brought into a perpendicular position. I have also found this appliance very useful in straightening up tipped molars and closing the space caused by the loss of a tooth as in the lower arch, Figure 9. When there is excessive extrusion of the anterior teeth, they can be depressed, if the twin wires are made to lie gingivally and are then sprung up into the locks. (Note lower anterior teeth, Figure 9.)

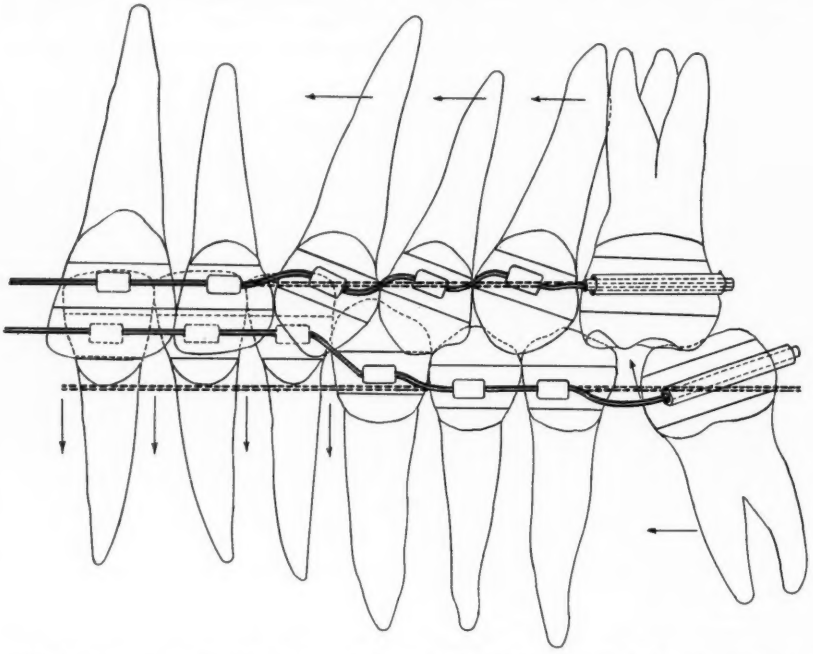

Fig. 9.—Crowns of cuspids and bicuspids tipped forward by means of twin wire automatic appliance.

Figure 10 shows how I obtain anchorage on the molar teeth. This can be done in two ways. In *A*, Figure 10, a lingual appliance is used to stabilize the anchorage. Since the lingual appliance is made of 0.036 inch wire, the pressure exerted by the twin wire is so small that it has

no effect on the molar tooth. In those cases in which it is not desirable to have a lingual appliance, as, for example, those in which we wish to move molars distally, the twin wire appliance is locked on the anterior teeth and the ends are bent to lie passively over and parallel to the tubes on the molar bands, as in *B,* Figure 10. The appliance is then removed, coil springs are placed over the end tubes and the appliance is locked into position on the anterior teeth.

I might mention at this time that this appliance is exceptionally effective in moving molars distally by the method just mentioned. When I am gaining this movement, I always use the twin 0.014 inch wires for the reason that, if an intermaxillary rubber is attached to a smaller sized wire, there is a tendency to pull it down and cause a tipping of the molar teeth.

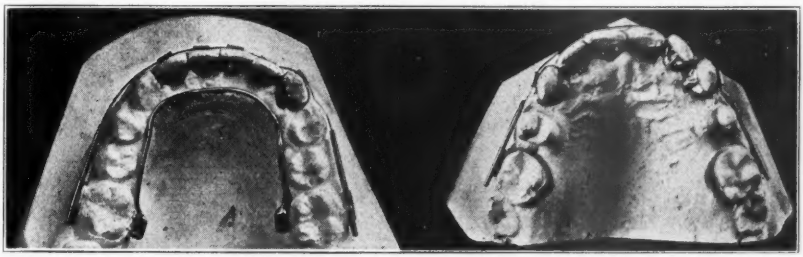

Fig. 10.—Method of obtaining anchorage.

Figure 11 illustrates the method used in drawing together widely spaced central incisors. Frequently, the roots are tipped toward the median line and the crowns are divergent. This condition is automatically corrected with the twin wire appliance. The normal alinement arch is represented by the dotted lines. When it is sprung into the locks, it assumes the position of the heavy lines. The resiliency of the steel wire causes the apical ends to move apart and the mesio-incisal edges to move toward each other. Since the twin wires slide through the locks, a silk or wire ligature is used to draw them together. Figure 11, *B* is an incisal view of *A,* showing how the rotating of the central incisors is carried on at the same time.

Some teeth are so irregular that it is not advisable or possible to seat both of the twin wires in the lock at the beginning of treatment. In *A,* Figure 12, the two methods employed in elongating teeth are shown. As you know, we must be careful not to draw a tooth down too quickly. Instead of both wires being placed in the lock, only one of them is so placed, as on the right central incisor. When this gradual pressure has elongated the tooth quite a bit, the other wire is placed in the lock and the tooth brought to its normal position. This method was used in the case shown in Figure 15.

Another method used to elongate a tooth is by running a 0.010 inch wire ligature through the lock and tying it to the twin wires as illustrated on the cuspid in *A,* Figure 12. Often a tooth is so badly rotated that it is not advisable to seat the twin wires completely. In order not to exert too much pressure, the female lock is only seated about two-thirds of the way, as in *B,* Figure 12. In two

or three weeks after the tooth has been rotated somewhat, the female lock is completely seated. There are instances when a tooth is so far out of line that it is not possible to detach the female lock after the band is cemented, as, for example, in a lateral incisor which is in bad lingual occlusion as shown in *C*, Figure 12.

The lock is placed on the band before it is cemented to the tooth and a 0.010 inch wire ligature is passed through the lock and ligated to the twin wire. When the tooth has been moved out so that it

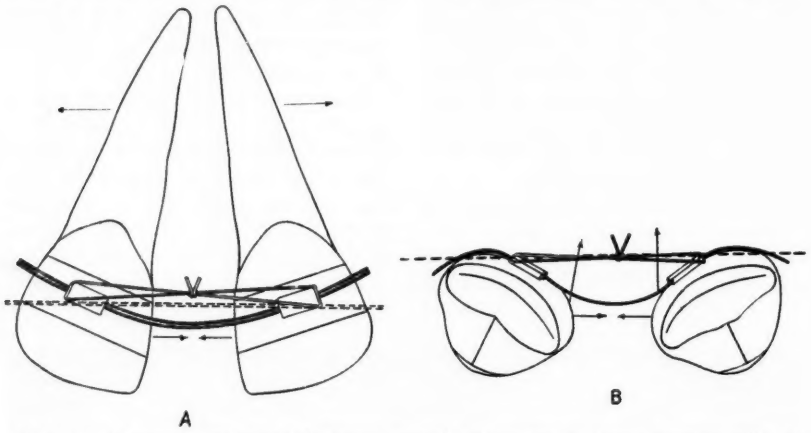

Fig. 11.—Manner in which widely spaced central incisors can be drawn together with this appliance.

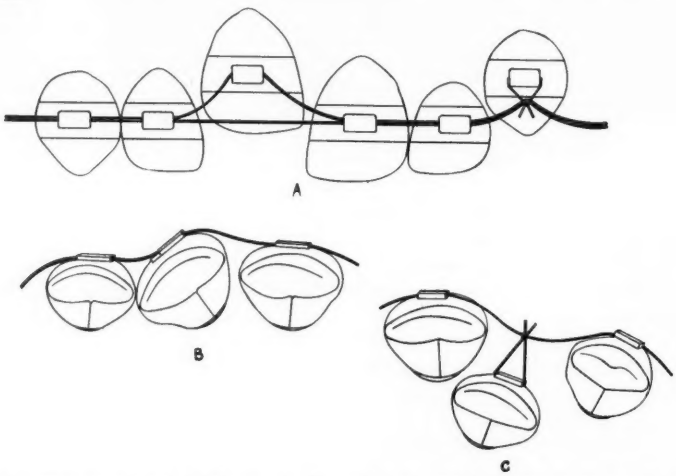

Fig. 12.—Two ways of elongating teeth. *B*, method of turning badly rotated tooth. *C*, tooth in alinement when in bad lingual occlusion.

is possible to detach the female lock, it is then handled in the usual way.

In a few cases, with this appliance, the teeth were moved so rapidly that I was astonished and alarmed. Although the patients did not complain of discomfort and the roentgenograms showed no absorption of the roots or of the process, my curiosity was aroused as to how much pressure I was exerting on these teeth. The scale shown in Figure 13 was designed to measure the force exerted on the individual tooth. The end of the stem of the scale has a groove in it, and, when the twin wires represented by the dotted line are seated in the lock on the

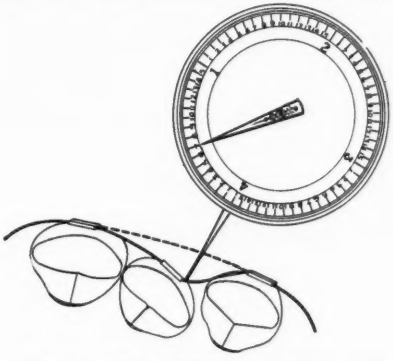

Fig. 13.—Scale designed to measure pressure exerted on individual tooth.

lateral aspect, the scale registers the amount of force used to accomplish this. To my surprise, I found the average pressure on the tooth ranges from 2 to 10 ounces, depending upon the irregularity of the teeth. I also found by this same method that a 0.010 inch wire ligature attached to an 18-gage arch wire often exerts from 2 to 4 pounds pressure.

From the foregoing, it will be seen that the appliance exerts a very gentle force, but owing to the fact that it is constant, the teeth are moved very rapidly and without any discomfort. The same scale can be used to determine the pressure exerted by the finger springs, lingual arches, coil springs and other types of appliances. These scales opened my eyes regarding the amount of pressure exerted on the teeth by some forms of appliances in common use today.

Figure 14 shows the method employed in opening spaces for partially erupted or unerupted teeth. A 0.009 inch stainless steel wire is made into a coil spring to fit the twin wires. The spring is stretched quite a bit longer than the space between the locks on the lateral and central incisors. The female locks are then forced into position, compressing the coil spring. Since the twin wires slide through the locks, the teeth are moved apart bodily.

A case that was worked in the above described manner is shown in Figure 15.

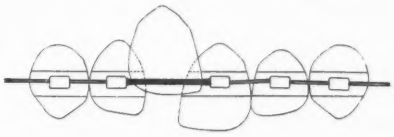

Fig. 14.—Method employed in opening spaces for partially erupted or unerupted teeth.

You will note that the right lateral and the left central incisor were depressed at the same time that the right central was brought into position. The results in this case were accomplished in six months. In fact, in all the cases here shown, the results were obtained in six months or less time. I find it necessary to recement the bands every six months, and these models, with the appliances on them, were made when the bands were recemented at the end of the six months' period.

Figure 16 shows the appliance used in the treatment of a distoclusion case, complicated by the absence of an upper right second bicuspid and a lower left second bicuspid. In Figure 17 are views of an

appliance which is used to move the first molars distally when they have drifted forward and closed up the space of the second bicuspid. You will note that I use coil springs on the end tubes, and, since the appliance is rigidly locked to the anterior teeth, the molars cannot tilt, but move distally in an upright position. In this type of case, I use twin 0.014 inch wires, because, if intermaxillary rubbers are used with a lighter wire, they tend to pull the small wire down and tip the molars. Frequently, in this type of case, the twin wire is formed to fit gingivally and is then sprung down and locked into position. This upward force will counteract the downward pull of the intermaxillary rubbers and prevent elongation of the anterior teeth.

The appliance on a neutroclusion case, complicated by extensive elongation of the central incisors, is shown in Figure 18. In this type of case, I use the 0.009 or the 0.010 inch twin wires and locks with the double 0.010 inch channel. The appliance can be sprung and locked to all the teeth as in *A,* Figure 18, or, if it is not desired to exert that much force, wire ligatures can be passed through the locks and ligated to the twin wires as in *B,* Figure 18.

Figure 19 shows the results of six months' treatment of a distoclusion case, complicated by the loss of the lower left first molar and the absence of the upper left cuspid. You will note that the root of the right central incisor has been tipped toward the median line. Figure

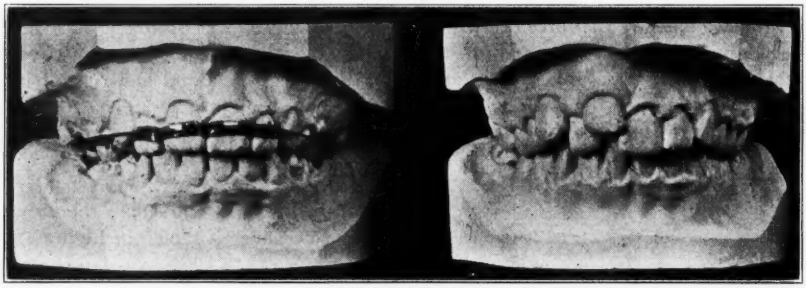

Fig. 15.—Case in which space was opened and right lateral and left central incisors were depressed at same time that right central incisor was brought into place. Results shown here were obtained in six months' time.

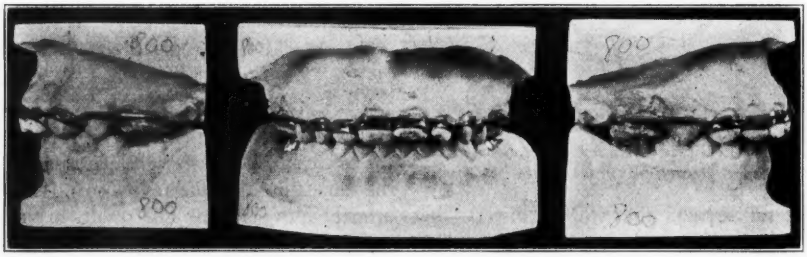

Fig. 16.—Appliance used in treatment of distoclusion case, complicated by absence of upper right second bicuspid and lower left second bicuspid.

20 is the occlusal view of the same case, showing how a lingual appliance was employed to spread the arch.

A typical unilateral distoclusion with a tendency to an open bite is shown in Figure 21. I started working on this case with the regular 18-gage alinement arch. The open-bite condition continued to grow worse and the lateral incisors came in rotated. The boy was a difficult patient to handle, and it looked as if I were due for a failure. This was one of the first cases on which I used this new appliance. I decided that since I was not securing results with the old type of arch, I could not do any worse with the new. I therefore put the twin wire appliance on. The model on the right shows the results obtained in six months.

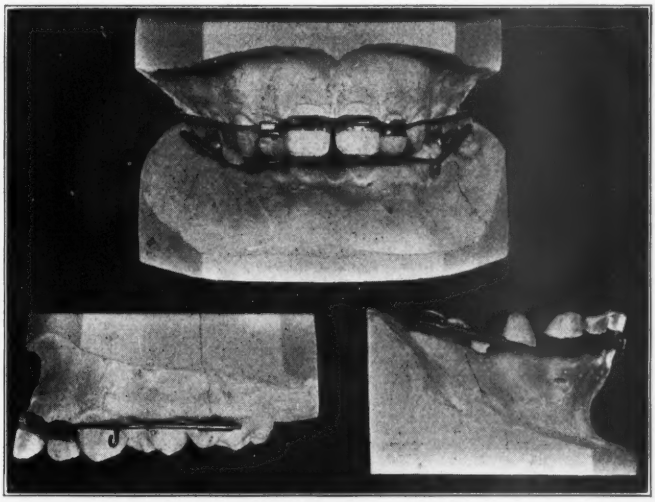

Fig. 17.—Appliance used to move first molars distally when they have drifted forward and closed the space of second bicuspid; coil springs over end tubes.

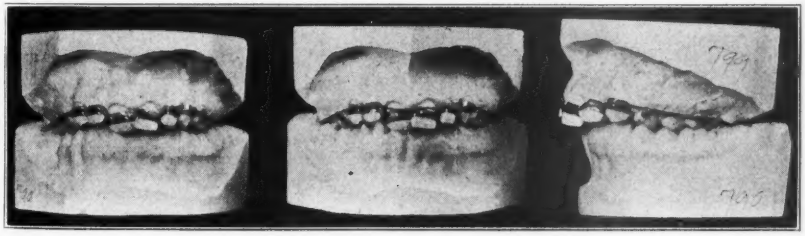

Fig. 18.—Appliance on neutroclusion case, complicated by extensive elongation of central incisors.

I might say at this time that children who give me trouble when they are required to wear wire or grass ligatures get along nicely with this new type of appliance. As the locks present a smooth

surface to the lip and do not annoy them, the appliance is very easy to keep clean.

The results obtained on an open-bite case in six months can be seen in Figure 22. The amount of lengthening that has been done on the maxillary lateral incisors is evident. The lower incisors have also been brought up to some extent. I have roentgenograms of these cases which show that there is no absorption of roots or process nor destruction of pulps.

Figure 23 shows a case which I diagnosed as a drifting forward of all of the upper anterior teeth, complicated by a deep overbite and a crowding of the lower anterior teeth, and also the drifting forward of the lower molar and second bicuspids on the right side.

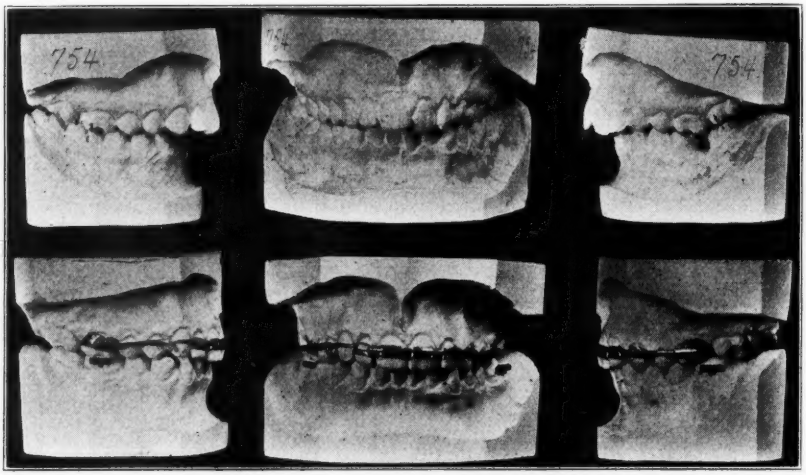

Fig. 19.—Results obtained in six months on a distoclusion case, complicated by loss of lower left first molar and absence of upper left cuspid. The root of the right central incisor has been tipped toward the median line.

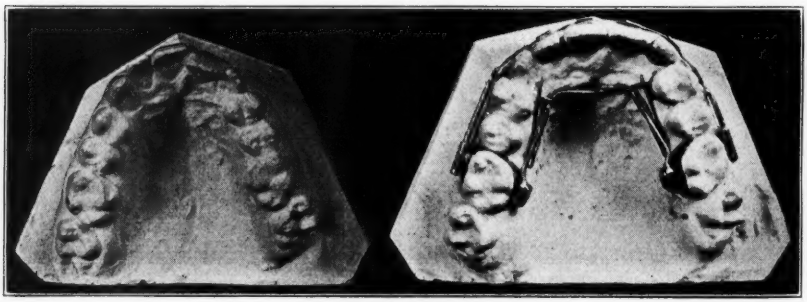

Fig. 20.—Occlusal view of case in Figure 19, showing use of a lingual appliance to spread arch.

The appliances used on this case are shown in Figure 24. Coil springs were

used over the end tubes of the upper appliances. Intermaxillary rubbers were used to keep the upper anterior teeth from moving labially. Note particularly how the roots of the right lower lateral are inclined to the median line.

In Figure 25 are views of the case after six months' treatment. You will note that a normal mesiodistal relation has been obtained; that the space for the upper right cuspid has been gained and the lower teeth have been brought out into good alinement. This improvement was accomplished with only three adjustments of the twin wire alinement arch. In fact, the results in all of these cases that I have shown have been obtained approximately by two or three adjustments of the appliance.

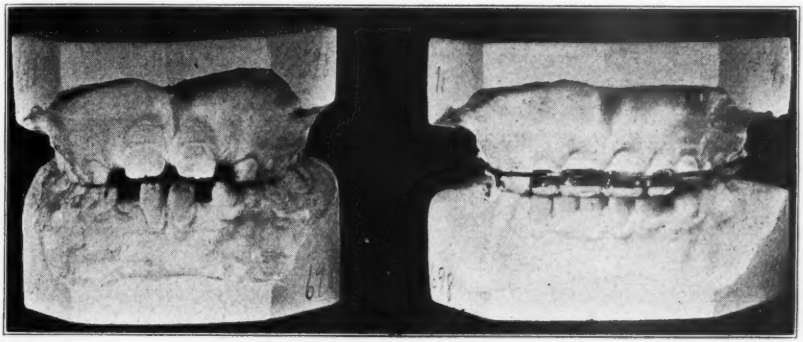

Fig. 21.—Typical unilateral distoclusion case with a tendency to open bite. The case seemed to grow worse with the use of a regular 18-gage alinement arch, but, as can be seen, good results were obtained with the twin wire alinement arch. The model on the right shows results obtained in six months with this appliance.

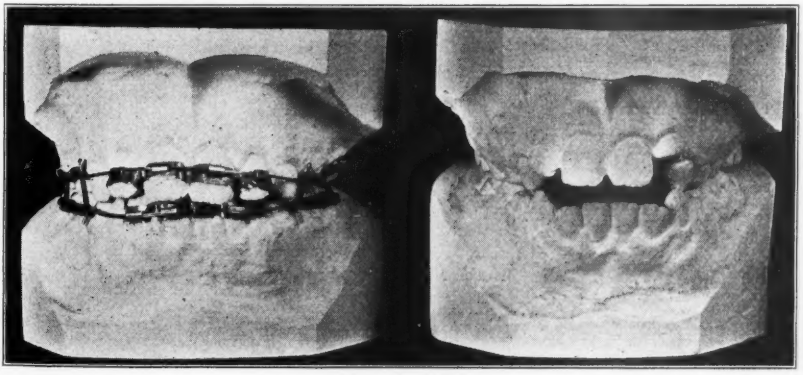

Fig. 22.—Open-bite case with results obtained in six months. The maxillary lateral incisors have been lengthened and lower incisors have been brought up to some extent.

SUMMARY: ADVANTAGES OF THE APPLIANCE

1. This appliance is very simple to construct and operate, since all that is needed is to bend the twin wire aline-

ment arch into a normal arch form and lock it to the teeth.

2. The teeth are automatically moved out to this normal arch form.

4. The teeth are moved rapidly without discomfort to the patient and the tissues are not injured.

5. The appliance is easy to keep clean;

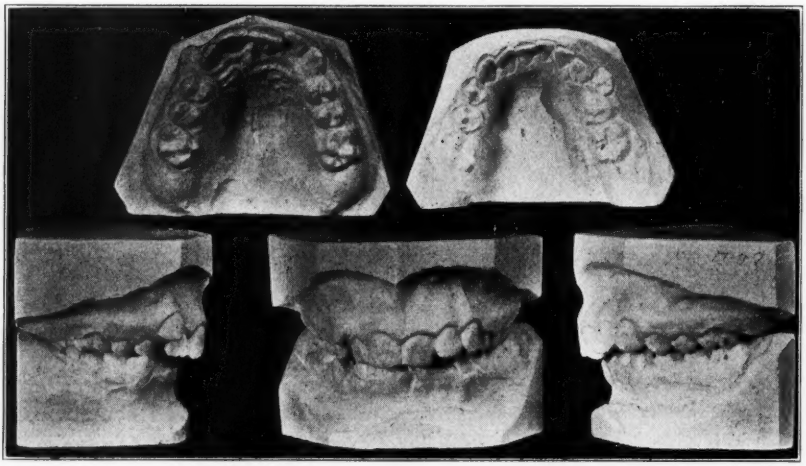

Fig. 23.—Case in which all upper anterior teeth had drifted forward, complicated by a deep overbite, crowding of lower teeth and drifting forward of lower molar and second bicuspids on right side.

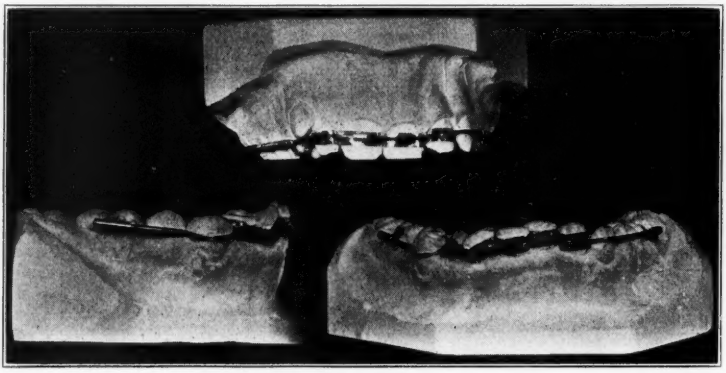

Fig. 24.—Appliance used on the case shown in Figure 23. Coil springs were used over the end tubes of the upper appliance and intermaxillary rubbers kept the anterior teeth from moving labially.

3. Root as well as crown movement is obtained automatically with the appliance.

is of neat appearance and is sturdy, notwithstanding its fragile appearance, be-

ing seldom broken by the patients, and continues to work over a long period of time. Frequently, when it is removed after three or four months, I find that it is still exerting pressure on the teeth.

6. While the pressure is constant, it is very light and produces physiologic tooth movement.

7. The operator has perfect control of the force being exerted.

The appliance has one disadvantage: It is necessary to place bands on the teeth which are to be moved. While the band is more conspicuous than a wire ligature, I do not believe that it causes so much decay, if properly fitted, and I am sure causes less discomfort to the patient.

DISCUSSION

Harry E. Kelsey, Baltimore, Md.: Dr. Johnson has presented an interesting variation of the type of appliance which demands a lock attachment on each tooth, and has made use in the arch wire of a material which, under proper control, is the best that has ever been produced. Stainless steel, as we all know from our experience with ligatures, remains as clean in the mouth as pure iridioplatinum, and very much resembles it, but is far stronger and more resilient and will not crystallize and crack as will iridioplatinum and, to a greater extent, the gold platinum alloys. The great objection to it, of course, is that it cannot be soldered; which makes necessary some sort of bracket or lock attachment on each tooth to which pressure is to be applied. We have many cases in which we require such attachments and for these cases I think the appliance Dr. Johnson presents is admirable.

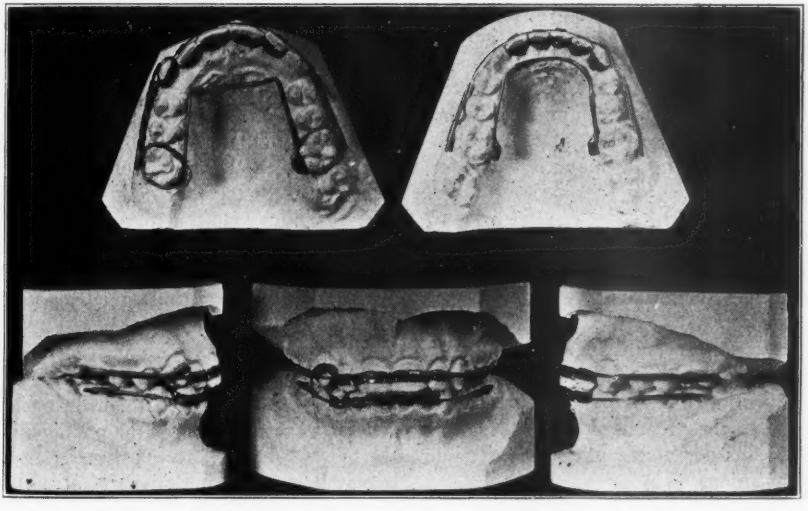

Fig. 25.—Results obtained in six months with only three adjustments of the twin wire alinement arch in case shown in Figures 23 and 24. A normal mesiodistal relation has been obtained; space for the upper right cuspid has been gained and the lower teeth have been brought out into alinement.

INTRA-ORAL METHOD OF ESTABLISHING MAXILLOMANDIBULAR RELATION*

By CLYDE H. SCHUYLER, D.D.S., New York City

THE means of securing proper maxillomandibular relations has been a favorite topic of discussion in dental literature, and in the scientific sections of dental meetings for many years. I have no new revelations to make, but if my efforts aid the general practitioner in his problem of securing a more accurate record of the rest position of the mandible in relation to the maxilla, to be used in the mounting of casts on an articulating instrument in the process of denture construction, or in the mounting of completed dentures for the purpose of perfecting occlusion, I shall consider that a service has been rendered both the profession and those who are so unfortunate as to wear artificial dentures improperly related.

Harmony of centric maxillomandibular relation and centric occlusion of dentures is essential if we hope to ensure to our patients the greatest degree of comfort and efficiency or the minimum of tissue destruction.

So often has the necessity of the Gysi gothic arch as a means of securing centric maxillomandibular relation been called to our attention that we may have lost sight of another condition of equal importance; that is, even contact of occluding surfaces.

Strained relations have often been spoken of, and are usually referred to as resulting from a position of the mandible posterior to its normal rest position. This is rarely, if ever, secured, but a comparative condition develops coincidentally with the settling of dentures; that is, with closing of the maxillomandibular space when a deeply interlocking tooth form is used.

It is possible to place a millimeter or more of material between the molars and bicuspids on one side of a natural dentition and, with slight muscular tension, bring the teeth together on the opposite side. A similar condition may occur when records are made using compound or wax, if, owing to an uneven thickness or density of occluding rims, greater pressure is required to displace excess material on either side. This uneven pressure or premature contact of areas of occluding surfaces may also disturb the relation of record bases or the relation of the finished dentures to the tissues. The mandible may be in its most retruded position to the maxilla from which lateral movements are possible when records are made, and yet there may be a disharmony of occlusion in this position when cases are completed.

Uneven occlusal contact in maxillomandibular rest position, such as a premature contact on one side, premature contact of the posterior teeth or premature contact of the anterior teeth, appears to cause greater annoyance to the patient and more tissue destruction than

*Read before the Section on Full Denture Prosthesis at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 22, 1931.

a position of the mandible slightly anterior to its normal rest relation to the maxilla, if we secure a balanced contact of tooth surfaces from the true centric maxillomandibular relation to the established protrusive position. Unless this balance is secured, we have a double complication; that is, incorrect centric and uneven distribution of stress, and seldom when dentures are occluded in a protruded relation do we find a balanced occlusion as the mandible moves from the true centric relation to the accepted position. Even though this disharmony is classed as secondary, it is undesirable.

The first requisite in securing maxillomandibular records is a perfectly adapted base-tray. Good results can be obtained by the use of the shellac baseplate material, properly adapted and reinforced. This material softens sufficiently at a reasonable temperature to be adapted to all details of the cast. It must be reinforced for adequate rigidity, and, while being used, must often be submerged in cold water, preferably ice water, to pre-

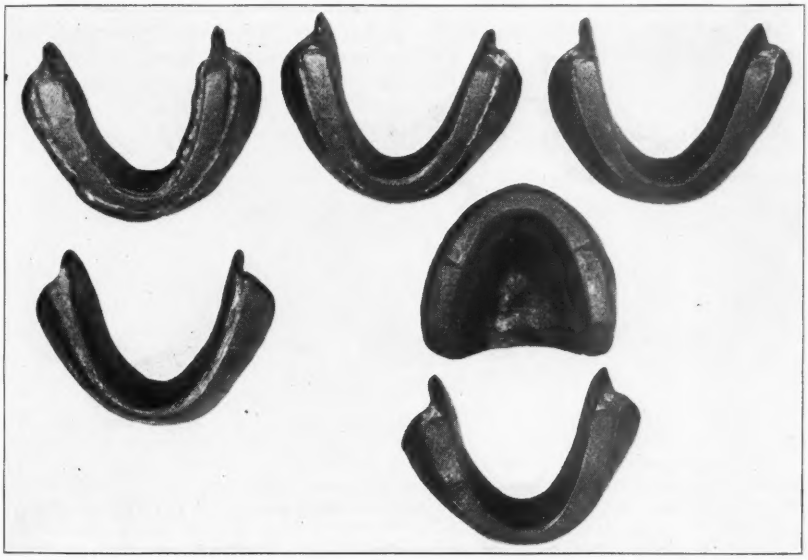

Fig. 1.—Occlusal rim formed on base-tray (right, near center), establishing the length of the anterior teeth, occlusal plane and facial fulness. Notches are placed in the second bicuspid region before the final record is made. Above, left, first step in forming lower occlusal rim to obtain proper height and relation to upper rim. The occlusal contact has been uneven and excess pressure was used in displacing the material. Center, same, with excess compound removed and warmed preparatory to second insertion in effort to equalize occlusal contact as shown at right. The degree of opening should now be 1 or 2 mm. in excess of the desired position. Below, left, occlusal surface warmed 2 or 3 mm. in depth and pinched to crest. The surface is then reflamed, and the final record, shown below, right, taken with little occlusal pressure, care having been taken to insure proper seating of both base-trays, and the placing of the mandible in its most retruded relation to the maxilla. The height of the occlusal rims should now establish the desired maxillomandibular opening.

vent distortion under occlusal pressure. Many men use a more rigid base-tray material or metal lined with compound, while others prefer to use vulcanite base-trays. The latter is unquestionably the most accurate for record purposes.

In my hands, compound has appeared to be more satisfactory for occlusal record rims than wax, as it can be softened more evenly to the desired depth, it does not cool so rapidly and, when chilled, is not so easily distorted.

After the bases have been formed to the cast, the desired occlusal plane and facial fullness is established with the maxillary occlusal rim of modeling compound. This occlusal surface is trimmed to approximately 3 mm. in width in the anterior region, and to approximately 5 mm. in width in the posterior region. Compound is then added to the lower base to approximately two thirds the desired height of the rim while the base is on the cast. The compound and tray are then chilled in ice water while still on the cast, to prevent distortion, after which additional compound may be added to the occlusal surface without danger of distorting the base. This is then placed in the mouth, and the patient is requested to close in the rest relation. This is done to secure a proximity of occlusal rims. At this point, the maxillomandibular degree of opening should be about 2 mm. in excess of the normal, after which the occluding surfaces are conformed and reduced to the desired thickness. The surface of the lower rim is again warmed to an even depth, preferably about 3 mm. and is then returned to the mouth. The patient is again instructed to close very lightly in the normal rest position. This closure must be less than the depth of the warm plastic material. The compound is then chilled, and the bases are removed and trimmed.

Fig. 2.—Methods of securing or checking maxillomandibular records when teeth are set in wax or after completion of dentures. Two thicknesses of baseplate wax have been formed over the surfaces of the lower teeth. Left: After first insertion; showing greater contact on one side and uneven displacement of material. Excess material is removed. Center: After material is warmed and the second record taken, showing more even distribution of contact. Excess material is again trimmed away, and the surface rewarmed. Right: Even distribution of pressure with slight contact in the anterior region No contact has been made between opposing tooth cusps, but they should be separated by only a millimeter or so of material. Each time, care has been taken to insure the proper seating of base-trays, and the placing of the mandible in its most retruded position in relation to the maxilla.

We should now have a set of rims of even thickness and well related to each other, with little possibility of uneven occlusal pressure and also possessing the proper maxillomandibular opening. Very small interlocking notches are now cut in the occlusal surface of the maxillary rim in approximately the area of the second

bicuspid. The occluding surface of the lower rim is warmed and pinched to a gable-like peak. It is again warmed and returned to the mouth, at which time a special effort is made to have the patient close lightly and in centric maxillomandibular relation. The compound is quickly chilled and the bases are removed from the mouth and submerged in ice water. Excess compound is removed from the lower base. The notch on the occlusal surface of the maxillary rim and the corresponding elevation on the surface of the mandibular rim serve to lock them in

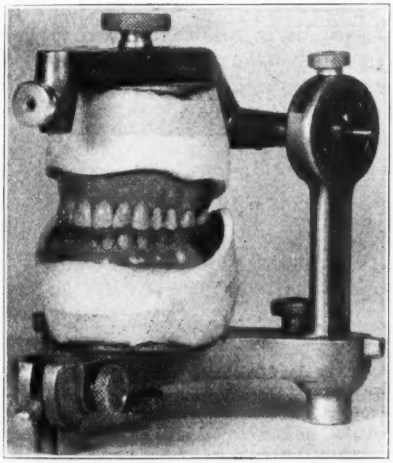

Fig. 3.—Denture remounted. After cases are mounted, intra-oral records are again made, as shown in Figure 2, and are then taken to the instrument. The mounting is not accepted as accurate until it has been checked and proved by such additional records.

proper relation. They should now be returned to the mouth, and all possible checks be made to assure that centric maxillomandibular relation has been secured, with an even distribution of occlusal stress.

The facebow is now applied and the casts mounted on the occluding instrument. The value of the facebow has received liberal discussion in the past two years. Even though it may not be applied and used with absolute accuracy, casts mounted on an intercondylar articulator are unquestionably mounted with greater accuracy than are those mounted without it, and it does not seem logical that one familiar with the problems of denture prosthesis can conscientiously recommend discontinuing its use with these instruments. When an instrument adjustable in three dimensions is used, the use of the facebow is unnecessary; but this type of instrument is used by few men.

After casts have been mounted on the articulator, preparations may be made to check the anteroposterior, maxillomandibular relation with a Gysi gothic arch tracing. This was not done previous to the mounting, as the interlocking of occluding surfaces would not permit it. Many prefer to leave the occluding surfaces of the rims smooth, recording the relation between them by the placing of slots and compound keys on the buccal surface of the occluding rims. This method appears to me to be more hazardous, especially in the flat ridge cases, owing to a possible lateral displacement while placing the compound keys which serve to lock them.

I do not consider a record secured on compound or wax occluding rims sufficiently free from error to complete the cases without additional checks.

The teeth are now placed on the bases, with an effort to observe the desired esthetics, and the posterior teeth are articulated with no grinding of the occlusal surfaces.

At the next sitting, a layer (approximately 2 mm. thick) of wax or compound is placed over the occlusal surfaces of the teeth of the lower trial denture. The material is warmed to an even depth

and a centric relation record made. This material is chilled and removed from the mouth, as the depth of occluding cusps is most often uneven. The occluding surface is now trimmed down so that just the points of the occluding cusps appear. This material is again warmed to an even depth, and the patient instructed to close lightly. We should now have opposing cusps penetrating to an even depth, over the entire occlusal surface. There should be only a layer of material approximately 1 mm. thick between opposing cusps, but no two cusps should be in contact, as this might cause a shift in the maxillomandibular relation, a movement of the base in relation to the tissue or an uneven distribution of pressure.

instrument with lateral adjustments, lateral records are made in the same manner to adjust the instrument.

Records are always checked by making new records in the mouth and checking them with the mounting or adjustment on the instrument, and never by the taking of a record from the instrument to be tested in the mouth, as has been taught by quite a few men. I consider this a waste of effort and a misleading practice. First, all records should be checked as accurately as possible before they are taken to the articulator. After the mounting of casts, and before the record is removed, it is possible to check against error in handling the instrument. A record taken from the instrument would

Fig. 4.—Types of records that should never be accepted. The mandible may have been in its most retruded relation to the maxilla, but owing to an uneven displacement of material, an even contact of occlusal surfaces could not be expected in the finished cases. At the right, too much force has been exerted in displacing the material; in the center, an excessive unilateral displacement is indicated; at left, a greater amount of material has been displaced in the posterior region.

This record is now carefully checked in the mouth, and then transferred to the articulator that we may check our previous record. If the record is found accurate, it is accepted. If not, another record is made. If the same discrepancy is found, the lower cast is remounted. Another check record is then made in the mouth and carried to the instrument. Duplicate records, made in the mouth, must check with the instrument before we accept the relation as accurate. Protruded records, and if we are using an

show no error such as improper relation of mandible to maxilla, uneven occlusal contact or evidence of an improperly seated base not discernible before the record was placed on the instrument. It would be of no definite value as evidence that an error did not exist, but it is quite impossible to make a new record in the mouth and exactly duplicate an error. Only when two or more records taken from the mouth are found to be exact duplicates, can there be an assurance of accuracy in the maxillomandibular rela-

tion, with bases properly seated and even contact over the occluding area.

When a record is found to be inaccurate, it cannot be safely corrected without rewarming and correcting the entire surface. I have witnessed the placing of additional material over a portion of the occluding surface without rewarming the entire surface, or the rewarming of only a portion of the occluding surface in an effort to eliminate an uneven contact. We could hardly expect to secure the desired result in this manner, as either an insufficient or excessive occluding force would produce an uneven contact, or what we have termed a strained relation.

Fig. 5.—Another type of record not to be accepted. The arrow indicates the position where opposing cusps have been in contact. Records as shown in Figures 4-5 are most often associated with movement of the denture bases, uneven compression of tissue or uneven tension of the muscles of mastication and though they may have been secured with the mandible in certain relation to the maxilla, a disharmony of occlusion is the usual result.

I have also known dentists who, in an effort to secure records for the correction of completed dentures, had the patient close in the maxillomandibular relation until the occluding surfaces of the teeth were in contact, with no material interposed, keying this position by placing compound or wax against the buccal surfaces of the teeth. The possibility of securing an accurate record in this manner is almost inconceivable.

There are several ways of encouraging patients to close in the normal rest position. First, they should never be censored for a lack of cooperation. The desired cooperation is most often secured when the patient is at ease mentally and physically and wholly unaware of the importance of the operation. When both upper and lower dentures are being made, it is preferable to have the upper base or denture in position, as less time is consumed in seating the lower denture, and thus unnecessary chilling of the warm record material on the occluding surface is prevented. After the seating of the base, a forefinger is placed on both sides of the base in the area of the second bicuspid or first molar and the patient requested to close slowly on the back teeth. The mention of the back teeth and the position of the fingers in that position has a definite psychologic effect on the patient, favorable to securing the desired relation. The position of the fingers makes possible the proper seating and retention of the lower base, and the operator develops a sense of touch that aids him in detecting an eccentric position of the mandible.

The patient may be requested to place the tip of the tongue far back on the palate and to hold it there while closing. It is quite impossible for one to protrude the mandible when this position of the tongue is retained.

After records have been chilled, they may be checked by having the patient close and swallow simultaneously, as the mandible is normally closed in the rest relation to the maxilla in the act of swallowing.

Records are often improperly transferred from the mouth to an articulator,

owing to an imperfect seating of the denture base upon the cast. The presence of a small particle of plaster or wax on either the cast or the tissue surface of the bases will readily prevent an accurate seating of the base to the cast. Even though materials are carefully handled, we must be constantly alert to guard against the possibility of error.

Great care should be taken to avoid loss of occlusal harmony in the flask while completing the dentures. Flasking material should be sufficiently hard and limited pressure used to avoid tooth movement in expelling excess denture material. Both cast material and flasking material should retain their firmness and undergo the minimum of dimensional change during the curing process. Portions of the flask should fit definitely and it must be properly closed. An improperly closed flask may cause such a disharmony of occlusion that correction is impossible.

Completed dentures must be remounted in order to check the relation and to perfect the occlusion after the curing of the denture material. This may be accomplished by securing new records in the same manner as suggested for the trial denture, or the original record may be retained by employing a nondisintegrating cast material, and remounting in the original position on the instrument, as suggested by Dr. Hight.

The occlusion must be again checked after the dentures have been worn for a period of a few days. Regardless of how accurately the work is carried through, the construction procedure, the settling of denture bases to the tissue of the mouth, will cause a disharmony of occlusion that can be determined and corrected only by securing new records, and by remounting on an adjustable instrument.

I have intentionally failed to emphasize the use of the Gysi gothic arch. It is a check against error in securing one of the many requisites of a harmonious relation between maxillary and mandibular dentures. Overcaution against error is impossible, and a slight error during denture construction may prove to be incorrectible after the completion of the cases, or may be corrected at a great sacrifice, but our final records must be made after the dentures are completed, at which time the use of the Gothic arch is impracticable, and other means of securing accuracy must be resorted to.

The problem of occlusal harmony cannot be forgotten when casts are mounted on an articulating instrument. Neither should our efforts end with the completion of the dentures. Perhaps no other one step or operation in full denture procedure is so vital to the comfort and happiness of the patient, and in the minimizing of tissue destruction. Therefore, as constant tissue change is occurring under denture bases at their best, and as such change is unfavorable to occlusal harmony, we should instruct the patient to have a periodic inspection.

At no time during denture construction should we be satisfied to accept what appears to be an even distribution of occlusal contact in a centric maxillomandibular relation without first taking duplicate records from the mouth, and checking them against a mounting on an articulator, as slight errors, which produce instability of dentures in service, and unnecessary trauma to the tissue, may go undetected, owing to the flexibility of the maxillomandibular articulation, the compressibility of the tissues and the mobility of denture bases; while, on the articulator, we have an immobility of bases resting on firm, noncompressible material, and a lack of flexibility in the

articulation apparatus, and only when they are examined under these favorable conditions can the extent of disharmony be determined and corrected.

DISCUSSION

F. M. Hight, Houston, Texas: Dr. Schuyler says that the rest position of the mandible establishes the relation of the mandible to the maxilla in which casts should be mounted on the articulator. This would then be the relation of the maxillary to the mandibular ridge in which the teeth will be articulated. This is the point at which actual construction of the denture begins, all previous work having been preparatory. Dr. Schuyler accepts the rest position of the mandible as centric relation. I do not believe the rest position of the mandible to be at all the same as centric relation, and I believe that the confusion of one of these terms with the other has done more to disturb the minds of plate workers than any other one thing of which I can think at the moment. I shall try to distinguish between the rest position of the mandible and centric relation as I understand these terms by discussing four points: 1. The theoretical and practical difference between the rest position of the mandible and centric relation. 2. The importance of centric relation as a starting point for denture construction. 3. How centric relation may be obtained and recorded. 4. How centric relation may be lost during flasking of the dentures, even after it has been obtained. The rest position is that which the mandible naturally assumes when not in function. No maxillary force is being exerted, and the mandible drops until the teeth are out of contact and the muscle pulls are balanced. It is probably the only position of the mandible which is entirely free from strain. Every other position is reached by a stronger pull in one direction than in another, and is therefore a position of strain. Centric relation is reached only by muscle strain, that is, by stronger muscle pull in some directions than in others. It is a functional position, and not one which the mandible tends to assume when there is no food between the teeth. At the end of the masticatory function, the mandible may move from centric relation to the rest position. The position of the mandibular incisor point in the rest position is generally somewhat anterior to and perhaps to one side of its position in centric relation. In centric relation, both condyles are in the most retruded position in the fossae from which the mandible can make lateral movements. In the rest position, the condyles are probably somewhat more forward and the mandible can move in any direction, even backward. The practical difference is that the rest position is not a safe position from which to begin the construction of dentures, and dentures constructed from it will usually be found unsatisfactory. On the other hand, centric relation is the one safe and satisfactory position from which to start the construction of dentures and dentures made from it are more likely to be satisfactory than those made from any other position. Centric relation is the position in which the mandible finishes the masticatory excursion. To crush food between the posterior teeth, the mandible moves downward, sideways and upward into lateral occlusion, and inward to the end of the excursion. It is then that the condyles are back in the fossae and the maxillary and mandibular incisor points are in about the same vertical plane. It is this position which we should register as the starting point for denture construction, and it is to this position alone that we should give the name "centric relation." Centric relation can be best obtained by putting the mandible in that relation to the maxilla which it will occupy at the close of the masticatory excursion. You will recall that at this time the condyles will be in the most retruded position from which the mandible can make mandibular movements. A more retruded position is possible to some patients under greater strain, but the mandible cannot make lateral movements from it. Perhaps the existence of centric relation can be recognized by some operators from the position of the condyle heads, or from other relations, to identify the position of centric relation by causing the mandible, at its incisor point, to record a pattern on a waxed plate supported upon the mandibular occlusion rim. The record traced in this way is, to my way of thinking, the only exact guide for the recognition of the existence or nonexistence of centric relation. When the mandible is in centric relation to the maxilla, a gothic arch with a sharp point will be traced in the wax. When the mandible is protruded, the point of the tracing will not be sharp. Whether or not the gothic tracing is the only method by which centric relation can be obtained, it is the only method by which the

dentist can tell how far, and in which direction, the mandible is out of central relation, and how far and in which direction it must move to establish that relation. Many dentists have been led to form a wrong opinion of the difficulty of obtaining centric relation in the average case because they have encountered difficult cases before they have mastered the technic. This is not a unique experience in other forms of dental work, and should not be regarded as more discouraging than it would be in inlay work, for instance. Sometimes jaw muscles are stiff, or the patient does not well understand what is to be done, or requires time and practice to learn to do it after he understands. Sometimes patients have lost natural teeth in such a way as to force the jaw to take a centric relation anterior to that which it had when all the teeth were present. A similar condition may result from wearing artificial dentures with a protrusive position as a starting point. Gothic arches recorded from any of these conditions will not have a sharp point. Not until the mandible goes back to true centric relation can a gothic arch with a sharp point be produced. The importance of knowing, before denture construction begins, how far and in which direction the mandible is closing out of centric relation, and which way and how far it must go to be in centric relation, cannot be exaggerated. The fact that centric relation has been obtained, and that teeth have been arranged to it, is no guarantee that the finished dentures will be in centric relation. That is frequently destroyed during the closing of the flask. It is almost sure to be lost if the manner of closing the flask, or looseness between parts of the flask, permits a change of relation between the cast and the teeth. Any dentist can demonstrate this for himself by making the casts of some material which does not disintegrate during flasking, by grooving the surfaces of the casts which will be next to the articulator bows and by remounting the casts upon the articulator after vulcanizing is completed, and observing the extent to which the relation of the maxillary and mandibular teeth have been changed. It is perhaps not out of place to say here that errors of this sort can be largely avoided by vulcanizing the maxillary denture first, by remounting it and by adjusting the mandibular teeth to any changes of position by the maxillary teeth, while the mandibular denture is still in the wax. Errors arising during flasking should not be allowed to change the dentist's conception of the importance of starting denture construction from centric relation.

Dr. Schuyler: I agree with Dr. Hight's definition of centric maxillomandibular relation, and accept it as the correct starting point for denture construction, but it is equally important that this position be recorded without lateral strain, compression of supporting tissues or displacement of recording bases. There is a possible reason for Dr. Hight to censure the term "rest position" as I have used it in my paper. It has been associated with that position which the mandible often assumes when not in function, at which time the teeth are out of contact. It would seem that our dental vocabulary here again might be considered deficient. If the mandible were at rest only when the teeth are out of contact, one would not experience fatigue of the muscles which control the mandible when the latter is void of teeth. In a practical way, there are two rest positions of the mandible in relation to the maxilla; the one, as previously mentioned; the other, a position in which the opposing teeth are in contact, and in that position where the forces of inclined planes are neutralized. Where natural teeth are present, this rest position, or what might be termed centric occlusion, is seldom in harmony with centric relation, and is most always anterior or lateral to it. This disharmony, the major cause of periodontal disturbance of the natural teeth, may be caused by irregular tooth eruption, and it is also the common result of natural tooth wear. In edentulous cases, when records are made on flat occlusal planes, the controlling cusps being absent, this rest position and centric relation are consistently identical, and when a lateral or protrusive relation is secured, it is associated with muscle strain. Being in accord with Dr. Hight in regard to the "safe position from which to begin the construction of dentures," I have no objection to having this position checked by the Gysi gothic arch, but I believe simultaneous occlusal contact to be of equal importance, and centric relation with uneven contact is quite as unsatisfactory as even contact associated with an eccentric relation. A denture constructed with harmony between centric relation and centric occlusion, and even distribution of occlusal stress, is the ideal for which we strive, but the very nature of the supporting tissues precludes the possibility of this harmony being permanent. Therefore, unless these dentures were remounted and

corrected to eliminate the disharmony resulting from the uneven settling of the bases to the tissues, which takes place in the first few days or weeks, and that resulting from subsequent changes which occur over periods of months or years and due to uneven tissue absorption, I would not feel that I had fulfilled my obligation to my edentulous patients. Unfortunately, these records cannot be checked by a Gysi gothic arch tracing, and I know of no method by which they can be secured more accurately than by the method that I have described. The necessity of checking all mountings, and the setting of the articulator by taking additional records from the mouth cannot be overemphasized.

DENTAL PORCELAINS

By FRED R. FELCHER, D.D.S., Chicago, Ill.

WE read much in dental journals regarding the use of porcelains in dentistry which may seem confusing because of the variations of technics described and suggested by different writers. There are many things to consider in the use of this material, not only regarding the material itself, but also regarding the variables that govern the conditions of firing, such as current supply, muffle variations and pyrometer conditions.

It would not be amiss, therefore, to start this article with a brief discussion of what I shall call "general porcelains," those which are used in the ceramic industry as differentiated from the dental porcelains produced for dental use. Comparative analysis of these two will yield some things that may be of interest, no doubt helping us in the use and firing of the dental material.

GENERAL PORCELAINS

The ceramic industry produces products of great scope. It is an important as well as an integral part of our everyday surroundings. Brick, glass, pottery, dishware, etc., are continuously being produced. In the manufacture of these various materials, there must be a thorough knowledge of the substances used in the formulas, their physical properties and characteristics and the reactions to be expected during burning or firing which produces the necessary pyrochemical changes, making, as a result, porcelain products of greater strength and density, products capable of withstanding heat (refractories) and pressure (spark plugs, electrical porcelain, chemical porcelains, etc.). It will be found that certain clays have definite physical properties and characteristics capable of assuring results for certain definite uses. For instance, the mineral known as andalusite, a form of sillimanite, mined extensively in California, is widely used in the manufacture of articles when strength against heat and pressure are desired (spark plugs, etc.). When sillimanite is produced synthetically during the burning process, there results what is known as a "hard" porcelain. Sillimanite is a needle-shaped form of silica, highly refractive, very dense, hard and strong. It is found in nature in certain volcanic rocks and is synthetically produced during the burning of bodies containing kaolin, the conversion point being about 1350 C.

There are also other forms of silica, such as tridymite and christobalite, having high refractive properties, these also being produced synthetically during firing. For example, heating silica up to

1000 C., and then gradually bringing the temperature up to about 1500 C. over a period of many hours will produce a synthetic christobalite, a high refractory used in a great many instances, and recently used in experiments for producing investment materials for dental use.

While it may be reasoned that the above-mentioned materials do not enter into the equation as far as dental porcelains are concerned, one does occasionally see them mentioned in dental journals. In the main, it must be remembered that, in the ceramic industry, just as in the use of dental porcelains, definite results are sought; and in endeavoring to get the best from the materials used, and to have the final products fulfill all that is required of them, there is little room for short cuts.

Generally, a clay ready for use would be composed of a high refractory material, a framework, so to speak, a material capable of giving plasticity and holding the shape of the ware as well as aiding in the end result of firing, and a flux to aid in the pyrochemical change. According to the formula, the physical properties of the clay or clays used, the flux or the fluxes and the method of burning, a definite article would be produced.

Let us assume that the results of compounding, milling to the required mesh and, finally, the production of the material would give a white porcelain. Coloring may be added by the use of metallic oxids during the compounding of the formula, or it may be applied over the fired ware in the form of colored glazes. A body, therefore, would, in the main, be composed of silica (flint or quartz), (SiO_2), kaolin (Al_2O_3 $2SiO_2$ $2H_2O$), and felspar (potash [orthoclase]) or soda (albite), depending on the kind and the purpose of the ware. The kaolin may be of one certain kind, or it may be a mixture of, for example, English ball clay, Florida kaolin or Tennessee kaolin. Therefore, the proper selection and compounding of the materials, together with the burning, will give wares for definite purposes.

POROSITY

All porcelain bodies when fired present porosity. In some wares, this is a necessity (water coolers), and the degree of porosity may be governed by the fineness of the milled material and the kind and amount of flux material in the mix. The crystal formation in a definite body is not uniform owing to the different crystal shapes of the many ingredients. Spaces between the crystals may be the result of the use of water to aid in assuring plasticity, the removal of the combined water in the kaolin and the method of building the raw material, such as the casting of wares and the pugging.

GLAZES

Pores in wares are sealed by the use of glazes. These glazes may be applied after the wares are fired, when a lower fusing material is used; or the glaze may have the same firing temperature as the wares, and is sprayed over the "green" (unfired ware) and fired simultaneously with the ware. Most glazes are fritted materials; that is, they are compounded, then fired, and ground to be again fired, which makes them more critical to the secondary firing. These glazes may be transparent, or they may be colored, and in the latter case, the colors are obtained during the compounding by the addition of the necessary metallic oxids. In a completely fritted material, we would expect a minimum of porosity in the fired glaze. With a material having a partly fritted addition in its formula, there

would result, in firing, a completely vitrified surface, but a porous interior. It is this classification that our dental porcelains enter.

DENTAL PORCELAINS

Dental porcelains may rightly belong to the glaze family of porcelain products. They are in the main composed of the highest types of flint, white burning clay (kaolin) and fluxes such as orthoclase felspar, combined in some instances with other chemicals to determine the kind, such as high and medium fusing, and some frit, usually the fritted coloring materials.

FIRING

While all porcelain bodies have ranges wherein vitrification takes place and devitrification starts, bodies devoid of frit, such as are so much used in the ceramic industry, are not so critical in the burning process as are the fritted or the dental porcelains. The former are of the compounded formulas and fired to a definite degree, the firing point being usually determined by test blocks primarily fired. Because they are not so critical in burning, seger cones, distributed in convenient portions of the kiln, by their softening (bending) action, permit a determination of the temperature reached. For the firing of dental porcelains, the use of a calibrated pyrometer is important.

To the advantage of this material, it may be said that its range of vitrification may be anywhere from the melting point of the eutectic (the pyrochemical change of the lowest fusing material in the body) to where devitrification commences, a temperature below what is often acknowledged as the fusing point of the material. For example, with a high fusing, 2560 F. dental porcelain, 1900 F. may safely be accepted as the starting point, and 2400 F. the maximum temperature to which this porcelain should be subjected. With medium fusing S. S. White or Justi medium, 2200 F. would be the highest. With Twentieth Century 1900 F. porcelain, 1900 would be the highest, and the same for a mixed combination such as forty parts low S. S. White 1700 F. and 60 parts medium S. S. White 2300 F. For S. S. White low fusing 1700 F. porcelain, 1600 F. is the highest temperature to which it should be subjected.

A better test for devitrification of the porcelain during the firing at higher temperatures than that described above can be made thus:

Two porcelain jacket crowns are built on a model which has the contact teeth constructed of amalgam. After the high biscuit fire, where all the shrinkage is complete, but short of final vitrification, each crown is ground to fit perfectly between the contacts. One crown is fired for the final fire in excess of 2400 F., between that and 2560 F. The other is fired not higher than 2400 F., preferably at 2350 F., that temperature being held for the required number of minutes until vitrification to the proper degree of glaze. The first crown will be found too wide to fit between the contacts, while the second will fit perfectly. We might assume that the first crown entered the zone of devitrification when it passed 2400 F. By devitrification, we here mean loss of the shape of the mass with a tendency toward "balling."

It is well to remember this equation in the firing of dental porcelains: "Time plus heat equals required temperature."

The best firing results are to be obtained by the use of lower temperatures over a longer period of time for holding. In that way, there is a complete opportunity for the penetration of the heat

units throughout the mass, which makes possible the perfect reproduction of fine carvings, contacts, etc.

As a suggestion for a firing technic for high fusing porcelain the following is submitted, although many methods giving similar results can be worked out. In a three-bake porcelain jacket crown, the first or low biscuit fire may be had by timing the furnace beginning at 1900 F.; setting a time clock to ring in five minutes, and allowing the temperature to reach 2200 F. in that five minutes. The timer is then reset, and the temperature allowed to continue to travel to 2350 F. in another five minutes. This will allow a slow rise in temperature from 1900 to 2350 F. in a total time of ten minutes.

For the second or high biscuit fire, we carry out the same procedure except that the temperature by the end of the ten minutes is carried to 2400 F.

The final or vitrifying bake is a repetition of the first, or low biscuit, bake, where the temperature is allowed to slowly travel from 1900 to 2350 F. in the ten-minute period. At this time, we must not disturb the position of the rheostat lever. The porcelain is removed long enough to cool slightly, to determine the degree of the glaze on the surface. Let us assume that the surface glaze is insufficient for the requirements. The crown is then replaced in the hot furnace, the door closed, and the rheostat lever brought quickly to the highest button, so that the temperature will rise at once to 2350 F. Now the lever is retarded to a button which will hold the temperature constant at 2350 F. for the required few minutes. If the furnace does not hold constant, it will be necessary to manipulate the lever to hold at that temperature. If we assume that the holding button gives a temperature of 2300 F., more time will be needed for the final firing.

SHRINKAGE

Let us here briefly consider shrinkage of porcelains both general and dental. In the former, a natural state of plasticity exists owing to the clay content and the combined water in the clay. This chemically combined water is driven off at a very high temperature, while burning in the kiln. While the green wares are dried out, as far as the applied water is concerned, in drying ovens, the settling of the material in the kiln and the burning out of the combined water in the clay gives the first stage of shrinkage, known as the "air shrinkage." This is then followed by the "firing shrinkage," or the beginning of the pyrochemical change, first by the eutectic, and followed until the change is complete. With dental porcelains, when we have in part a fritted mass, there is little to expect in the way of plasticity, at least the natural plasticity found in clays. The plastic property must be supplied by the addition of a binder. In the manufacture of American artificial teeth, a binder such as gum tragacanth is used, which makes a thick mass and, in turn, is pressed into molds considerably larger than the fired tooth. Here, we find the greatest amount of shrinkage, at least as far as it applies to dental porcelains. In porcelains compounded for use in the construction of porcelain jacket crowns and inlays, binders such as sugar, starch or dextrin are added to give the necessary plasticity. In this case, no matter how the porcelain may be manipulated, there is less shrinkage than that found with the use of heavy paste binders. The spaces between the crystals are not so large; hence, there is less "settling" during the "air shrinkage" stage.

The amount of water used in the mix and the method of removal of the excess water will play a part in the shrinkage of the mass during firing, to be sure. It seems that the closer the crystals are allowed to come in contact with each other before the material is placed in the furnace, the less the shrinkage resulting.

An easy test can be made as follows: A small container such as a very small spoon is filled level with a wet mix of porcelain. Some dry porcelain powder is sprinkled over this so that when it is placed in dry powder, the wet mix will not run. The container is placed in dry powder, until all the water has been drawn off, removed, and, with a brush, all of the dry powder brushed away. It will be noticed that the spoon remains level full. We must assume that while the water has been drawn off, there has been no interlocking of the crystals, only spaces remaining to supplement the water.

To continue the experiment, we add a few drops of water to the container, and after allowing the water to seep through, vibrate with some instrument. The water at once comes to the surface, while the porcelain settles to the bottom. With a napkin, we carefully touch the surface water so that it will be absorbed, and remove. We continue to vibrate and remove the surface water until no more water comes to the surface. Aside from the settling of the crystals, allowing for an interlocking of these, it will be noticed that the porcelain has settled far below the rim of the container. It will also be noticed that if a carver is used to cut into the mass, it will be quite resistant to carving. Such a mix if fired would, to all indications, give a denser mix with less shrinkage.

The foregoing would lead us to assume that a method whereby vibration and the drawing off of the water was used would be ideal. This is, to all indications, true; but because we are attempting to produce a tooth composed of a body and an enamel color, the degree of the color being affected by the amount of the body color which is applied, to do this is not always entirely possible. To use such a method often precludes the possibility of building to accurate shape, requiring carving, which often sets up strains in the unfired porcelain that are not discernible until after the porcelain is removed from the furnace. These appear as cracks or checks in the fired material.

It seems obvious that some vibration must accompany the building up process, and this may be done while building up, vibrating and burnishing to shape the object desired. There is nothing new about the process, it having been used by earlier workers in dental porcelains. At least, there is less shrinkage by such a method than when no vibration is used.

DENSITY AFTER FIRING

As far as density is concerned, with a finely milled porcelain to start with, there does not seem to be a great degree of difference in the fused porcelains. While there is a great amount of shrinkage in the teeth manufactured in molds, grinding into these shows very little if any appreciable difference in porosity. Slow firing at low temperatures again comes to aid as it makes possible a thorough pyrochemical change throughout the mass. This should be the governing factor in firing porcelains.

OTHER VARIABLES

There is another factor in firing worthy of consideration; that is, the variations found in current supply, muffles, etc. With a material as critical in firing as dental porcelains, firing to

temperatures, aside from the dangers of devitrification, is uncertain in many respects. Let us assume, for example, that a temperature rise from 1900 to 2560 F. is accomplished in eight minutes. We will assume that we have vitrified the material by such procedure. Examination will show that the surface is vitrified, and, particularly in bulk porcelain, the center is not thoroughly fired. Again, we will assume that a load on the line which supplies the current to the furnace lowers the electrical supply and makes the next firing reach 2560 F. in ten minutes instead of eight as before. The result, then, will be overfiring.

Because heat affects the platinum resistor of the furnace, causing it to thin out, old muffles are slower than new ones. The heat of the muffle may also affect the thickness of the thermocouple wires, causing a change in the electromotive force, by which the current supply generated by the heat is transmitted to the pyrometer. It is therefore good policy from time to time to calibrate the furnace.

GLAZES

Slow firing is also important in the use of glazes such as are available for our use, just as for porcelains. While glazes for dental use are not of a critical firing nature, allowing a long time to reach the desired temperature will give smoother results. There will be less "pitting," and the material will "flow" properly over the surface of the porcelain to which it is applied.

ANNEALING

Whenever possible, it is good policy to allow the porcelain whether for a restoration or in a glazing operation, to cool slowly for annealing purposes. Greater strength can be thus obtained. When time permits, the work should be allowed to cool in the furnace. Otherwise, it should be placed on an asbestos block and covered with a glass. The block may be a soldering block, but it should be used for porcelain work only. A block used for soldering purposes has particles of borax and often metal adhering to it. The red-hot saggar (fireclay slide) melts the borax which adheres to it, and when later placed in the muffle, fuses to the refractory, causing a short-lived muffle. If a metal is present, it will alloy with the platinum and give a quick burn out.

7515 Kingston Avenue.

THE SECOND PRESSURE SYSTEM OF UTILIZING ATMOSPHERIC PRESSURE FOR THE RETENTION OF FULL LOWER DENTURES

By DOUGLAS H. YOUNG, D.D.S., Attica, N. Y.

PHYSICAL science tells us that the atmosphere exerts a pressure of 14.7 pounds to the square inch on all objects on the earth, our bodies included. Since the average man has a body surface equal to about 16 square feet, we find, by multiplying 144, the number of square inches in a square foot, by 14.7, the number of pounds pressure on each square inch, that this pressure equals

2,116 pounds, or more than a ton, to the square foot, and since we have 16 square feet of body surface, the pressure on each of us is more than 16 tons.

This gives us an idea of the strenuous life we are compelled to live; but this high pressure is our lot, and not our choice.

In this principle, there is nothing new. We all familiarized ourselves with it when in school, and yet few of us realize that it is true today, and that it is an ever-operating law of nature which, if brought under our control, may be made to serve many desirable purposes.

This principle has been very successfully applied in the retention of upper dentures, which not so very long ago had to be held in position by springs.

Is there any good reason that we should not also make use of this benign law of nature for the purpose of retaining the lower denture, which has always been considered a *bete noir* in dentistry? This force which is so well adapted to application in the human mouth is the first law of nature, the law that the new born babe makes use of by creating a partial vacuum in the mouth, thereby sucking in its mother's milk to satisfy its first pang of hunger. It is this same law that makes it possible to swallow every mouthful of food that we take.

In the edentulous lower jaw, it is about the only force we can lay hold of to add to the patient's comfort and to our own credit.

I shall now attempt to define what seems to be a normal mouth or the shape of jaw to which this method of securing retention is best adapted. There is, of course, a great variation in the shape of jaws. Some are well rounded; some are very sharp and thin; while others are low and flat. But as long as the jaw has the general characteristics of being hard on the crest of the ridge, with soft compressible or displaceable tissue at the point to which the border of the denture comes, it does not seem to make any difference provided, as I have just stated, the tissues are cushion-like at the border of the denture so that there is a peripheral seal, and thus atmospheric pressure is secured.

I believe that a large percentage of mouths come under this classification. Some who are using this system assert that the percentage is as high as 95. If these figures are correct, the other 5 per cent would not present favorable conditions because there is hardness at the lower border, with soft ridges or some other unfavorable condition. Deep undercuts too are not favorable.

Of course, plaster of Paris is an ideal impression material in many respects, but it will not give the kind of impression that is desired in this particular method because we cannot use a second pressure on it after it begins to set without spoiling it. Therefore, I use an impression compound.

First, I select a tray which fits the case in hand as nearly as possible, then take an ordinary impression and in a few minutes I can make a hasty model. Now I can bend and trim the tray until it fits this model. I have the patient well up in the chair, in order to see just what I am doing. Taking a fairly liberal portion of the impression material, nicely distributed on the tray, I place it in the mouth, and with the two thumbs under the jaw and the two index fingers placed on the tray at a balanced point where they will evenly distribute the pressure over the whole jaw, I press down at right angle to the jaw, with a steady pressure, about three-fourths of the distance that it is to go. I then stop and hold steady

until the compound has stiffened to such consistency that from 6 to 10 pounds pressure will be required to force it down the last fourth. I then hold it steady again with about one-half the amount of pressure used in forcing it down the last time, until the impression material has hardened sufficiently not to change its shape.

Now we have an impression that is entirely different from the ordinary impression, but in what way? When I press down the first time, I get an ordinary impression, but after the material has hardened to the point where from 6 to 10 pounds pressure is required to force it down the last one-fourth, I then have an impression that is different.

When I press down the second time, the hard ridge of the alveolus cuts just a little deeper into the impression material and remains practically unchanged, while down at the point where the border of the denture comes, the soft cushion-like tissue is compressed or displaced to such a degree that the border of the denture has a peripheral seal. If we are dealing with a normal mouth and we make the model from this impression and the denture on this model; when the denture is finished, put in the mouth, pressed to place and we have the patient bite down on it and suck the air out from under it, we find that it will stick.

The borders need to be trimmed to relieve the upward pull of the muscles, but not too high lest we break the suction action. There is a line to which we may trim them and so avoid interference with muscles and breaking the seal. With a little thought and experience, the ability to get the right adjustment can be acquired. Do not be discouraged if your first patients have to come back several times to get the right adaptation.

While some will accept our best service of this kind as a matter of course, believing that every lower denture should adhere just as naturally as the upper, the great majority of patients will realize and appreciate that we have rendered an unusual service.

The test of what we have accomplished may be measured in this way: With a very small drill, a hole is made between the two central incisors in the vulcanite and a small wire run through the hole. The ends are fastened together, a loop about 6 inches long being made. The patient puts the denture in the mouth and bites down, at the same time sucking the air from under it. Now a spring balance is hooked in the wire and pulled straight up at right angles to the upper surface of the denture. This will indicate approximately the number of pounds pull required to displace it.

The patient for whom I made the first denture of this kind, twenty-seven years ago, had not been in my office during that time. I had seen her several times, when she had spoken of how much comfort her teeth gave her. Last winter, when preparing to give a clinic on this subject at the Chicago midwinter clinic, I asked her to come to the office and found by the foregoing test that a pull of 4 pounds was required to displace the denture.

I tested the last three dentures I had made and in two cases it required a 6 pounds pull to displace the plate, while the third, being larger with more surface of contact, required a pull of 9 pounds. The force required to displace the denture depends on the size of the surface of contact.

One thing I ask of those who may care to test this plan is that parts of other systems be not used in your technic. These procedures may be correct in some

technics but will not combine to advantage with this system.

For instance, many operators wish to do the muscle trimming while taking the impression, but this will be disastrous as the impression tray should be held perfectly steady while we are taking the impression, just as we should hold a camera steady while making an exposure. The muscle trimming is done on the denture after it is vulcanized and put in the mouth.

INTERRELATIONS OF OCULAR AND DENTAL PATHOLOGY*

By W. D. ROWLAND, M.D., F.A.C.S., Boston, Mass.

MY first premise is that pathologic dental conditions are recognized as an etiologic factor in a certain percentage of diseases and functional disturbances of the eye. Both the dental and medical groups of the profession find too much evidence in the literature, doubtless, to question it. Wilmer[1] has shown that history records clinical evidence of this relation two centuries ago. In the last year of Washington's lifetime, more notice was given the subject. After bacteriology became a part of medical education, the evidence became more apparent, and from then on, more exact knowledge regarding the relations formerly suspected to exist or only clinically proved led to demonstrated pathologic entities. Accumulating evidence presented by careful observers in considerable volume is now available to a student of the problem.

*Read before the intern staff of the Forsyth Dental Infirmary, Boston, Mass., May 22, 1931.

*From the Department of Ophthalmology, Boston University School of Medicine and Massachusetts Memorial Hospitals.

1. Wilmer, W. H.: Relation of Teeth to Affections of Eye, D. Cosmos, 72:1189-1199 (Nov.) 1930.

ROUTES OF INFECTION

If it is granted that infection travels from the alveolar processes of the mandible and maxilla, our first problem is: How can the transmission be accounted for? Tivnen,[2] quoting Benedict of the Mayo Clinic, outlines three routes: 1. Through bone directly from the alveolus to the orbit. This is possible when apical infection destroys the adjacent alveolar structures and infecting organisms travel through the less resistant cancellous osseous tissue to the orbit, where it emerges along penetrating vessels and attacks contiguous tissues. 2. Through or under the periosteum, quite directly from the alveolus to the orbit. Both of these routes of travel are limited anatomically to the maxillary source, the mandible not lending itself to a similar process. 3. Through the blood stream. This, doubtless, is the most frequent, logically the most rapid and consequently the most important of the transference processes.

To these, doubtless, may be added three other routes: 4. Through the lymphatics. This implies a rather direct

2. Tivnen, R. J.: Ophthalmologic Phase of Focal Infection. Tr. Am. Acad. Ophth. & Otolaryn., 1927, pp. 63-77.

tract, somewhat similar to the first and second listed, but not necessarily identical. 5. Along the fifth cranial nerve. Fox lists this as an important route of travel for inflammatory or reflex irritation, which seems quite logical since the first division of this nerve has orbital and intra-ocular terminations. 6. From open infected areas in the mouth direct to extra-ocular tissues, commonly by the fingers.

Table 1—Infections Found in Two Hundred Cases of Iritis, First and Second Series, 1916 and 1923*

Infections	Alone	With Other Infections	Total	Coincident Infections: Syphilis	Gonococcal	Tuberculosis	Dental	Tonsillar	Sinus	Nonvenereal Genito-Urinary	Other Infections
Syphilis	12	26	38	..	8	6	13	10	3	..	..
Gonococcal infection	8	2	10	..	..	..	1	1	..	..	..
Tuberculosis	8	..	8	..	..	..	..	..	..	..	..
Dental infection	12	15	27	2	2	2	..	9	3	..	..
Sinus infection	1	3	4	..	..	..	2	1	..	..	..
Tonsillar infection	26	27	53	5	3	4	22	..	1	1	1
Genito-urinary, nonvenereal	6	..	6	..	..	..	..	..	..	..	..
Other infections	3	..	3	..	..	..	1	..	..	..	..
No infection found	..	..	3	..	..	..	..	..	..	..	..
Combined infections	..	41	41	15	12	11	27	35	15	1	5
Undetermined	..	7	7	3	..	1	2	1	..	..	2
Total			200								

*Irons, E. E., and Brown, E. V. L.

TYPES OF ETIOLOGIC DENTAL CONDITIONS

Of great interest is the nature of the dental lesion to be indicted for complicity in the pathologic assault. Here, the evidence seems often quite indirect or circumstantial, but frequently because of the clear clinical train of events, demands acceptance, and, fortunately, in not a few cases, pathologic study has afforded proof. Rosenow,[3] of the Mayo Clinic, has by animal tests demonstrated the elective localization of streptococci, with organisms obtained from an infected tooth in a patient with iritis producing a similar ocular condition in the animal injected.

Apical abscess, occasionally an infected vital pulp, infected root canals in pulpless teeth, septic residual roots, roots degenerating from nutritional disturbance following trauma, the alveolar process which has become infected after edentation, certain impacted and un-

3. Rosenow, E. C.: Iritis and Other Ocular Lesions on Intravenous Injection of Streptococci, J. Infect. Dis., 17:403-408, 1915.

erupted (infected) teeth, areas of true pyorrhea alveolaris and of various infections gaining entrance under separated gingival margins, all are charged with inciting ocular disease through their rôle as foci from which bacteria or their toxins reach the eye and related tissues. The presence of pulp stones, impaction of sterile teeth and malocclusion likewise have produced various functional disturbances reflexly through nerve pathways.

type of lesion. Of these three structures, the cornea suffers most because of possible destructive ulcers initiated by dental lesions and the resultant scars which may develop permanent visual faults. The lids, through perverted metabolism or a definite inflammatory lesion of their lubricating glands, may be affected. The orbit occasionally develops a periosteitis, localized abscesses or generalized cellulitis of its contents, most frequently by direct extension and rarely by metastasis.

TABLE 2—A REPORT ON FIVE HUNDRED CASES OF IRITIS FROM THE RECORDS OF WILLS EYE HOSPITAL (1909)*

Cause	No. Cases	Percentage
Syphilis	307	61.4
Rheumatism	127	25.4
Gonorrhea	26	5.2
Influenza	7	1.4
Exposure	7	1.4
Tuberculosis	6	1.2
Malaria	6	1.2
Childbirth	3	0.6
Typhoid fever	2	0.4
Intra-uterine inflammation	2	0.4
Diabetes	1	0.2
Gout	1	0.2
Pneumonia	1	0.2
Cerebrospinal meningitis	1	0.2
Measles	1	0.2
Lead poisoning	1	0.2
Rhus toxicodendron poisoning	1	0.2
	500	100.00

*Jennings and Hill: Am. Enc. Ophth., 9:6658.

NATURE OF OCULAR LESIONS AND MANNER OF PRODUCTION

Practically all tissues of the eye, its adnexa and orbital contents are vulnerable to infectious and reflex injuries arising from dental sources as from any other source of similar nature, such as infected tonsils, nasal sinuses, the gallbladder, appendix or intestinal tract, the prostate and the cervical glands (in the female).

The cornea, conjunctiva and sclera are occasionally involved by an inflammatory

Of much greater frequency are the severe assaults on the more delicate intraocular tissues. Iritis is the common pathologic entity encountered, the result of either bacterial invasion or toxin injury, and, unless quickly controlled, causing serious visual disturbance by occlusion of the pupil or the initiation of destructive organic processes. Somewhat less frequently is the choroid and its contiguous inlaid retina the seat of generalized inflammation with exudation into

the vitreous body, or localized inflammatory or purulent lesions causing destruction of tissues with resultant visual faults varying in importance according to the location of the lesions, central retinal or choroidal destruction rendering the patient blind for all direct or central vision, i. e., practically blind.

The crystalline lens suffers by involvement of adjacent tissues through adhesions and exudates on its surface or by nutritional disturbance due to the indirect manner of its metabolism, it being devoid of blood or lymph or nerve supply. The optic nerve may be injured by either toxins or inflammatory foci, the elimination of which must be readily accomplished in order to avoid permanent damage by atrophy. Not infrequently, that portion of the nerve supplying the central retina is the only part involved, but its involvement carries the same significance as above referred to under central choroid and retinal losses. Glaucoma, an intra-ocular disease characterized by an increased intra-ocular tension with the possibility of blindness has been found in some cases to be incited by reflex irritation from impacted teeth. Extra-ocular muscles may be involved functionally by reflex or toxic disturbance of their nerve supply. Likewise, the intra-ocular muscle which governs the function of focusing may be similarly affected. The retina, through mild toxic injury, may show fatigue. Various types of so-called eye strain or fatigue, therefore, can result from these functional disturbances just mentioned.

Rosenow,[4] in discussing elective localization from focal infections, says:

> While there is quite general agreement regarding the etiologic relationship of focal infection wherever found to diseases of the eye, there is still a difference of opinion regarding their nature, and whether they are due to localization of organisms or their toxins, especially in those that run a chronic course and that manifest periodic exacerbations and remissions. This is particularly true in those believed to be due to streptococci, because many clinicians still have the impression that all members of this group of organisms are highly virulent, and that any disease in the eye due to localization of streptococci must needs be severe and associated with suppuration. This is erroneous, for it has been proved beyond doubt that in the streptococcal group, more, perhaps, than in any other species of bacteria, there are individual strains of almost every degree of virulence. There are strains that affect, in diverse manner, a wide range of tissues or organs, while others have specific or elective affinity for particular structures without noticeably affecting others. Clinical evidence in support of these experimental findings is not lacking, for in some of the diseases of the eye, such as "rheumatic" iritis, the ocular symptoms are only a part of similar manifestations in joints, muscles, heart and other structures, while in most of them the condition in the eye, so far as can be determined, is the only manifestation of disease. The pathogenesis of this group, especially the mild, yet menacing affections, is still a puzzling problem. The difficulties of solution are many. Relief from symptoms following removal of foci of infection, while good evidence of causal relationship, still leaves open the question whether the lesions in the eye were the result of localization of bacteria or their toxins only. . . . The good effects commonly noted following removal of foci of infection support the experimental findings, justify a thorough consideration of their existence and call for removal or cure, as far as possible, of focal infection in every obscure clinical case. The successful application of the methods of study, while simple, require unusual facility of cooperation between bacteriologist and clinician. The experimental results indicate clearly that those lesions in the eye which are associated with exudation, even though slight, are usually due to actual localization of micro-organisms, while the milder manifestations may sometimes be due to absorption of toxins which are formed in the focus or elsewhere and reach the eye in the blood stream.

4. Rosenow, E. C.: Focal Infection and Elective Localization in Pathogenesis of Diseases of Eye, Ann. Otol. Rhin. & Laryn., 36: 883-895 (Dec.) 1927.

Localization of the bacteria in the eye may sometimes be accidental and a part of other disease manifestations. However, the animal experiments, now amply corroborated, indicate clearly that localization and growth in most instances are due to peculiar, acquired or inherent, properties within the bacteria themselves, and to their power to localize electively, and that this is in part due to the production of a toxin or poison which affects, specifically, the tissues in which localization and growth occur.

In all probability those marked lesions of the eye which clear up with remarkable rapidity after the removal of dental infections must be considerd to be the result of the presence of toxins rather than bacteria in the ocular tissues.

ETIOLOGIC DIAGNOSIS

To illustrate this problem, only one pathologic entity will be considered, and since iritis is one of the most protean, it lends itself very well to the purpose. Irons and Brown[5] say, in their analysis of 200 cases of iritis:

Each patient presents a problem for solution, the ascertainable facts being the history, including the time relations of the onset and recurrence of iritis and infectious processes of the several kinds, the results of physical examination and laboratory study, and the results of treatment directed to the removal or cure of the infections discovered.

The data in the accompanying tables serve to indicate the difficulty usually confronting the ophthalmologist in determining (1) the most effective procedures necessary in a given case to eradicate the etiologic factors and (2) the local treatment of the lesion in the eye. It will be noted in these tables that there is a marked falling off of venereal conditions, owing largely to the more efficient and early care of this group, especially since the late World War, and an increase in the number of dental infections found. The latter must be explained by the improved pathologic study as well as the more sincere and cooperative relations between the ophthalmologist and the patient's dental consultant. Certainly, the problem is too intricate for the ophthalmologist to make all decisions, even after adequate general medical advice and laboratory data are at hand. Our best teaching cannot condone eliminative trimming, whether applied to the removal of the readily accessible tonsil or teeth as against the less accessible intestinal or genitourinary lesions.

Before edentation is advised, the necessity for it should be established by an understanding and cooperative study with the dental consultant, realizing the limitations of roentgen-ray findings. The value to the patient of usable or cosmetic dental structures to be retained, if not responsible, as against ocular losses, if responsible, should be clearly in mind. The following is the practice at the Mayo Clinic.[6]

Where the systemic condition of the patient warrants elimination of all dental infection, we advise extraction of all pulpless teeth, regardless of the x-ray findings. From a bacteriologic standpoint, we have never been able to differentiate between pulpless teeth that show x-ray evidence of destruction at their apices and pulpless teeth that are x-ray negative.

As regards the question of root-canal filling as a dental procedure, the burden of proof must be accepted by the dental surgeon in each case, based upon the efficiency of the aseptic technic employed.

It doubtless is surprising to note that some observers believe certain dental lesions to be caused by ocular disease. Such is the opinion of Kahn,[7] who recites cases

5. Irons, E. E., and Brown, E. V. L.: Etiology of Iritis, J. A. M. A., 81:1770-1776 (Nov. 24) 1923.

6. Personal communication to the author.

7. Kahn, W. W.: Asthenopic Reflex Manifestations Between Eyes and Teeth, J. A. M A., 80:1134-1138 (April 21) 1923.

of dental neuralgia, toothache and sensitive dental structures in which relief was obtained when eye strain was relieved. This is explained upon the basis of reflex involvement through associated nerve pathways.

REPORT OF CASES

CASE 1.—*Effect of Reflex Irritation.*—Mr. M., aged 56, a business manager, complained of ocular discomfort and confusion, especially for close work, and defective night vision. He had been under considerable mental tension because of illness of his family. Recent treatment by his family physician had benefited him little. His general health was quite normal and no faults were discovered after careful physical examination. There were no dental symptoms.

With glasses, normal vision was obtained in each eye, but binocular cooperation was somewhat faulty. No definite muscular fault existed. No pathologic intra-ocular condition was revealed by the ophthalmoscope. The visual fields showed an enlarged blind spot in the left eye and intra-ocular tension was slightly above normal. This condition was somewhat improved by pilocarpin, which contracts the pupil and aids in drainage of intra-ocular fluids.

In seeking for sources of irritation, the use of the roentgen-rays revealed an impacted upper right third molar. This was removed, and there was a return to normal of the intra-ocular tension and the field fault was eliminated within four weeks. Likewise, he was freed from discomfort, ocular function returned to normal and his mental load was lifted.

CASE 2.—*Effect of Infection.*—Mr. M., aged 23, a shoe cutter, of Canadian birth, had lost the vision of the right eye within two days one week before consultation. Tests showed absolute loss of vision in this eye, which is quite unusual for one of that age, and normal vision in the fellow eye. His general health was good and he had been working without interruption. He was wearing full upper and lower plates, the teeth having all been removed five years previously. The nose showed septal obstruction, but the sinuses were clinically not pathologic. No demonstrable intra-ocular disease was observed.

With total loss of vision in one eye and one normal eye, the pathologic condition was either within the eye or presented an involvement of the nerve between the globe and the optic chiasm of that side. In consideration of the custom of early extraction in the Provinces, the patient was questioned about alveolar soreness, he replying in the negative. Likewise, inspection revealed no points of possible involvement from possible retained roots.

A roentgenogram of the sinuses was negative except for a mucous cyst in the right antrum. No impingement on the optic nerve was present by narrowing of the bony optic canal through which the nerve enters the orbit from the middle cranial fossa, but infected retained roots were found in three locations: the lower left third molar, upper left third molar and upper right third molar regions. On removal piecemeal, these retained roots showed both streptococci and staphylococci, from which autogenous vaccines were made and given the patient. The antrum was cleared of its cystic mass through the alveolus at the same time.

Within ten days, vision began to return and, with rather rapid improvement at the end of a month, the visual field had cleared except for a relatively small paracentral blind spot, with central vision better than one-tenth.

The patient was lost track of, but it might be expected that much better vision was ultimately obtained.

This was a retrobulbar involvement of the optic nerve, doubtless caused by toxins, probably by direct extension, or perhaps by selective localization.

CONCLUSION

I wish to emphasize that the dental surgeon is entitled to know and understand the ophthalmologist's problem in a given case, and his findings, when required by the ophthalmologist, should be based upon a current examination, both of roentgen-ray and clinical data, taking nothing for granted. If ultimate analysis allocates the case to the dental surgeon's province, he is entitled to be professionally informed accordingly, so that he may act with necessary intelligence and dispatch. There should be a common ground upon which intelligent conservatism and sane radicalism may meet.

A STATEMENT OF THE GIFT TO THE AMERICAN DENTAL ASSOCIATION MADE BY THE DENTISTS MUTUAL PROTECTIVE ALLIANCE

By M. D. K. BREMNER, D.D.S., Chicago, Ill.

IN JUNE, 1914, the Dentists Mutual Protective Alliance was organized for the purpose of defending the profession against suits brought to enforce the inlay patents. The following were the officers: M. D. K. Bremner, president; Frank T. Hays, secretary; L. T. Weinshenker, treasurer; board of directors: Charles W. Hall, Charles L. Lind (deceased), Arthur N. Cigrand, V. P. Cooley, H. C. Newton and Louis E. Jelinek.

Many difficulties were encountered owing to the powerful influences that were exerted against the Alliance, but after a fair test in the courts, the contention of the Alliance was sustained and the patents rendered null and void.

Therefore, we feel that the Alliance was fully vindicated and the profession was relieved from the exactions of the process patents. It is needless to reiterate all of the contention that developed at that time. It is a matter of history, and might as well be forgotten, but it at least should be said that the officers of the Alliance stood their ground against the various kinds of opposition that developed, and the result was that the profession was thereby relieved of what might otherwise have grown into a serious situation in the enforcement of process patents of all kinds. It established a principle that has meant much in the way of protection to the profession and the people. From that day to this, the profession has enjoyed a security that it never before had known.

After the lapse of a decade, the officers of the Alliance conceived the idea that a more permanent provision should be made against any possible future aggression that might develop in the way of process patents, and therefore opened negotiations with the American Dental Association for the establishment of a standing committee on process patents whose duty it would be to investigate any claim that was made whereby the profession or the people would be subjected to oppression through the medium of unjust process patents.

With this idea, the president of the Alliance approached some of the Trustees of the American Dental Association. As a result, he was invited to present the program of his organization before the Board of Trustees. The plan received favorable attention from the very start, and after several discussions, a joint committee was appointed to work out the details. This committee consisted of C. N. Johnson, Roscoe H. Volland and Harry B. Pinney, for the American Dental Association; and M. D. K. Bremner, Charles W. Hall and Louis E. Jelinek for the Alliance. The work of the joint committee resulted in the development of the following tentative plan: The Alliance was to disband and turn over the money in its treasury, $12,000 face value, in bonds to the Amer-

ican Dental Association as a contribution to the building fund. The American Dental Association was to add a committee on process patents and adopt the necessary amendments to its bylaws defining the duties of that committee.

To bring this matter to a final conclusion, it was necessary for the House of Delegates of the American Dental Association to adopt the plan and for 51 per cent of all the Alliance members in good standing to vote in favor of disbanding the organization and turning over the bonds to the American Dental Association.

There was no question about the action of the American Dental Association Delegates, but there was some doubt about the attitude of the Alliance membership. These men had not been communicated with for nearly a decade, most of them had probably forgotten about the $15 contribution or their affiliation with the Alliance. Would they be interested enough to express their opinion? Would they take the trouble to vote? Would they mail in their ballots? This was a serious problem; for unless the officers of the Alliance received the approval of the plan from 51 per cent of the members, they would be unable to proceed. There was nothing to do but put the matter to a test. Accordingly, a letter was mailed explaining the plan and giving the reason that each and everyone of the members should vote for it. With this letter, there was the following ballot.

THE DENTISTS MUTUAL PROTECTIVE ALLIANCE

KNOW ALL MEN BY THESE PRESENTS; that I, the undersigned, hereby constitute and appoint *M. K. Bremner, Charles W. Hall* and *Louis E. Jelinek,* or any one of them, my proxy and attorney, with power of substitution, to cast my vote for me at the special meeting of the Members of The Dentists Mutual Protective Alliance to be held at Room 1600, 5 South Wabash avenue, Chicago, Illinois, on January 20, 1931, with all the powers I should possess if personally present, and I hereby vote as follows:

————For dissolution of The Dentists Mutual Protective Alliance.
————Against dissolution of The Dentists Mutual Protective Alliance.

I hereby give to American Dental Association, an Illinois corporation, my distributive share of any funds due me as a member of The Dentists Mutual Protective Alliance, by virtue of or upon its dissolution, not to exceed the sum of about three dollars and fifty cents ($3.50), and do hereby authorize, empower and direct the Board of Governors or the Board of Directors of The Dentists Mutual Protective Alliance to pay over and deliver said funds to the American Dental Association.

THE DENTISTS MUTUAL PROTECTIVE ALLIANCE
(Incorporated)

Chicago, Illinois
June 15, 1930

To the Members of The Dentists Mutual Protective Alliance.

Notice is hereby given that a special meeting of The Dentists Mutual Protective Alliance will be held at Room 1600, 5 South Wabash Avenue, Chicago, Illinois, on January 20, 1931, at six-thirty P. M., for the purpose of voting on the proposition to dissolve the corporation. Time for voting expires at four o'clock P. M., on January 20, 1931.

The result was beyond all expectation. Of the 3,735 members in good standing, 2,105 or 146 above the legal requirement of 51 per cent, accepted the recommendations of the officers and voted in the affirmative. Those ballots are now in the vaults of the American Dental Association for safe keeping, the

receipt from them signed by the Secretary.

RECEIPT FROM A. D. A.

January 23, 1931.

Received from Dr. M. D. K. Bremner, President of the Dentists Mutual Protective Alliance, the following:

1. Copy of Minutes of a meeting held by the Dentists Mutual Protective Alliance on January 20th, 1931.
2. Two books: One containing the list of delinquent members of the Alliance, and one containing the list of members in good standing, which list shows the members in good standing numbering 3,735.
3. One box containing 2,105 affirmative votes cast in favor of the dissolution of the Alliance, and turning over the funds to the American Dental Association; 26 negative votes; also, affidavit showing that 459 votes mailed were returned because the post office could not deliver them, and 88 more were returned because the doctors have died.

Witness:

AMERICAN DENTAL ASSOCIATION
By
Secretary

With this problem out of the way, the rest was quite simple. The House of Delegates at the last Memphis meeting adopted the recommendation of the committee and the by-laws dealing with the process patent litigation became a part of the organic law of the American Dental Association.

The following is a copy of the letter received by the President of the Alliance informing him of the action by the House of Delegates.

AMERICAN DENTAL ASSOCIATION
212 East Superior St.
Chicago

November 19, 1931.

Dr. M. D. K. Bremner,
55 East Washington St.,
Chicago, Illinois.

Dear Doctor Bremner:

On Monday, October 19th, at the first meeting of the House of Delegates, Seventy-Third Annual Session of the American Dental Association, held in Memphis, Tenn., the following report was made by the Board of Trustees to the House of Delegates:

"It was voted that the following amendment to the Constitutional and Administrative By-Laws be referred to the House of Delegates:

Chapter XI, Section 3, add:

(k) Process Patent Committee.

Chapter XI, add Section 17 to read:

Section 17. (a) The Process Patent Committee shall be composed of five members. One member shall be elected each year, to serve for a period of five years, excepting that the first committee shall be nominated by the joint committee of the American Dental Association and the Dentists Mutual Protective Alliance. It shall organize by electing a chairman. The General Secretary of the Association shall be, ex officio, with power to vote, secretary of the committee. The latter shall keep a permanent record of its proceedings, shall conduct all correspondence, etc.

(b) The Process Patent Committee shall hold such meetings during the annual session and during the year as it may deem necessary. Three members shall constitute a quorum. It shall make an annual report to the House of Delegates.

(c) The duties of this Committee shall be:

(1) To collect each year a copy of all of the patents pertaining to dental processes, appliances and materials as they are printed by the Patent Office, and to make an annual report of its finding to the Board of Trustees of the American Dental Association;

(2) To ascertain by means of litigation up through the highest court of record if necessary the validity of all patents upon processes or methods used in connection with the practice of dentistry whenever such patent or patents are made use of directly or indirectly for the purpose of collecting royalties or license fees from the dentists of this country or whenever such patents are used in any other manner which tends to hamper the progress or manipulative skill of the dental profession;

(3) To raise the necessary funds by any method approved by the Board of Trustees of the American Dental Association. To hire attorneys, agents, office help, appoint committees, and such other duties as shall pertain to the furthering of the litigation;

(4) To publish the proceedings of all its meetings at which the question of litigation of a process patent is discussed, in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION not later than 60 days from the date of such meeting;

(5) To make an annual written report and financial statement to the Board of Trustees, said report to be published in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION only at their discretion.

(*d*) Any member who believes that his welfare is affected by a process patent may bring a resolution before his state society, giving his reasons why that particular patent should be litigated, and if the resolution is passed by a majority vote of the state society, it shall be forwarded at once by the secretary of the state society to the secretary of the Process Patent Committee who shall call a meeting of the Committee not later than 15 days from the day of receipt of the resolution. Two members of the state society suggesting litigation will be allowed to appear before the committee to discuss the resolution.

(e) If the Process Patent Committee decides not to litigate a patent, any member of the American Dental Association may appear before the council of his state society, and if upon consideration of the facts involved the council of that society shall pass a resolution disagreeing with the action of the Process Patent Committee, then this resolution signed by the president and the secretary of that state society shall be mailed at once to the president of the American Dental Association, who shall then call a joint meeting of the Trustees of the American Dental Association and the Process Patent Committee for the purpose of considering the resolution passed by the state society council. At these meetings the Trustees of the American Dental Association and the members of the Process Patent Committee shall each have the right to vote. The chairman of these meetings shall be the President of the American Dental Association. The president of the state society that has passed the resolution shall have the right to appoint two members who may be present at the joint meeting, take part in its deliberation, but who may not vote. The action of this meeting in all matters pertaining to the litigation of patents shall be final. The joint meeting shall be held not later than thirty days from the date of receipt of resolutions from the council of the state society.

(*f*) No process patent shall be compromised.

(*g*) The American Dental Association, through its constituted officers, shall authorize the treasurer to pay over, when needed, to the Process Patent Committee a sum of $1,000. This money is to be used for the initial expense of litigation, the raising of funds or for any other purpose as may be decided by the Committee. All funds advanced in this manner shall be considered a loan to be repaid by the Committee to the treasury of the American Dental Association at the termination of the litigation for which the loan was advanced, provided sufficient funds are available.

(h) Any funds that may be left over after litigating a patent shall be disposed of according to a decison of a joint meeting of the Process Patent Committee and the Board of Trustees of the American Dental Association.

The committee nominated by the Joint Committee of the American Dental Association and the Dentists Mutual Protective Alliance is as follows: Mark F. Finley, L. E. Jelinek, W. F. Walz, M. D. K. Bremner, C. N. Johnson and the Secretary of the American Dental Association, *ex officio.*

Action on the above was taken Thursday, October 22, 1931, by the House of Delegates.

"Dr. Casto: A resolution was presented Monday in the report of the Board of Trustees regarding a Process Patent Committee. It is rather lengthy. It has been recommended by the Board of Trustees. Do you wish to have it read again? If not, I move the adoption of that amendment.

. . . The motion was seconded by Dr. Pritchard and carried."

Very truly yours,

AMERICAN DENTAL ASSOCIATION

(Signed) H. B. Pinney, *Secretary*

By these amendments, organized dentistry declares that it will never submit to paying royalties or license fees for the use of a process patent unless ordered to do so by the highest court of record.

Another feature of these by-laws is that no small group of men whether honestly sincere but misguided or acting

for personal gain and profit will be able to compromise a process patent case contrary to the best interests of the profession.

The early history of the inlay patents when a few individuals on their own responsibility committed the profession to the validity of those patents and advised the purchase of licenses will never again be repeated.

The American Dental Association having performed its part, it was only necessary for the Alliance officers to turn over the bonds in order that the plan be completed. This was done on Dec. 21, 1931, as the following receipt indicates.

AMERICAN DENTAL ASSOCIATION
212 East Superior St.
Chicago

Chicago, December 21, 1931.

Received from the Dentists Mutual Protective Alliance, the following bonds, the principle and income of which are to be applied on purchase of property at 212 East Superior Street, Chicago:

Kentucky Utilities, $3,000
Northern Indiana Fuel and Light, $2,000
Southern United Ice Co., $1,000
Southern United Gas Co., $2,500
United Public Service Co., $500
United Public Service Co., $2,000
United Public Utilities, $1,000

AMERICAN DENTAL ASSOCIATION
(Signed) H. B. Pinney, *Secretary*
(Signed) R. H. Volland, *Treasurer*

The item of $42,618.81 for organization expenses may seem excessive but the explanation is quite simple. The Alliance was organized by a small band of men who were not well known in the profession, and it was therefore necessary to spend much time, energy and money in organizing the profession before a solid front could be presented to establish claims. To go into all of this at the present time is unnecessary, but the fact remains that in view of the necessities of the situation and the ultimate result, the expense was by no means excessive, and every cent of it was justified by the final outcome.

FINAL CONDENSED AUDIT
DENTISTS' MUTUAL PROTECTIVE ALLIANCE
FROM JUNE 29, 1914 TO DECEMBER 28, 1931

Receipts			
Membership Assessments and Interest			$101,249.43
Profit on Investments Sold			25.00
			$101,274.43
Disbursements			
Organization and membership expenses		$42,618.81	
Assessments (cost of collecting)		4,209.35	
Legal fees and expenses		41,400.14	
Dissolution expenses			
Legal fees	$ 25.00		
Auditing	50.00		
M. D. K. Bremner, services in connection with the closing of the affairs of the Dentists' Mutual Protective Alliance	1,153.63	1,228.63	
Securities on hand, Dec. 21, 1931, at cost; turned over to the American Dentists' Association		11,817.50	101,274.43

Respectfully Submitted,
JOSEPH M. CHECKERS & COMPANY
(Signed) JOSEPH M. CHECKERS,
Certified Public Accountant.

The Journal of the American Dental Association

212 East Superior St., Chicago, Illinois

C. N. JOHNSON, Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matters should be sent to the Business Manager.

Subscription is included in the annual membership dues. To nonmembers living in the United States or its possessions, the price is $2.50 a year in advance; Canada, $3.00; Australia, $4.00; other countries, $3.25. All foreign subscriptions are to be paid in United States money.

Editorials

THE CONTRIBUTION OF THE CLINICIAN TO RESEARCH

It matters little from what source information is obtained provided the information is authentic. In many of our dental problems, we are still groping in the dark. The intense activity in dental thought as evidenced through our literature is a hopeful sign of the times, but the problems that are actually being solved today are almost pitifully meager. This is not so much the fault of our investigators and writers as it is the inherent limitations of our common humanity. We are all anxious to add our mite to the sum total of established fact, but the trouble is to know for a certainty what is fact.

In dentistry, as in medicine, we are constantly being confronted with influences that tend to thwart our efforts and muddle our findings. The perpetual play of the life forces is sometimes so confus-

ing that we are left perplexed and bewildered. Our well laid plans of practice and our theories of treatment are often rendered null and void through the subtle influence of agencies over which we seem to have no control.

The difficulty is to evaluate evidence. One man sees a thing in a certain light, and another sees it in a wholly different light. One man bases all of his ideas on laboratory findings and builds his theories on that kind of evidence; another relies solely on clinical manifestations and lets it go at that. The logical thing would be to try to combine the two methods and absorb all of the light that he can from both. But more and more the fact is being borne in on our thinking men that clinical experience forms a more reliable guide for daily practice than laboratory tests. After all, the thing that actually counts is the real thing, the concrete experiences of every-day endeavor. It is what we accomplish in the mouth more than what we see in the test tube that tells the true story. Not that the test tube is not of great importance. We well know that we can do things in a test tube that we cannot do in a mouth; we can take liberties with inanimate material in the way of experiment that we cannot with living sensitive tissue. But mayhap for this very reason, we are less accurate in our conceptions when we base our judgments on the findings of the laboratory than when we study the mouth itself.

And this is the very point worthy of stress at this time. More and more, we must study the manifestations in the mouths of our patients, and we must make this study available for research. It will supplement the work of the laboratories immeasurably to have constantly at hand the results of clinical experience, and we venture to predict that the laboratories will welcome this kind of evidence. In this way every man or woman practicing dentistry can contribute to research, the general practitioner no less than the specialist. The only thing necessary is for the practitioner to make careful records of his clinical findings and preserve them in such a way that they can be made available when needed. It is a notorious fact that few of our general practitioners ever make records worthy of the name, and adequate records are the first great step toward a proper

tie-up between the clinician and the laboratory worker. As soon as our research investigators begin to realize the value of clinical records as they apply to a solution of some of their most pressing problems, and as soon as our practitioners make good by furnishing the right kind of records, we shall go a long way toward bringing about harmony between theory and practice, and this is a desideratum long sought and never yet fully realized.

Why is it not possible today?

A GREAT NEED

The program of the Council on Dental Therapeutics has for one of its objectives the publication of a book containing a list of acceptable drug preparations with suitable descriptions of their chemical, pharmacologic and therapeutic properties and uses. A large part of the Council's future program will be based on references to these useful drugs in dentistry.

The need for such a volume is apparent from the numbers of inquiries received by the Council regarding the publication of this book. The manuscript is nearly complete, but the problem is to finance the plan. At this time, the resources of the Association will not permit of its underwriting, and while various suggestons have been made, even to the one proposed by some members of the Council to underwrite it among themselves, or to have it sponsored by local groups of the Association, no feasible plan has as yet been worked out. Possibly, some one of the foundations may be induced to finance it when the urgent need is made manifest and the small amount necessary to launch it is considered.

In any event, some way must be provided whereby this book may be made available to the profession. Nothing of this particular character has ever yet been presented for the benefit of our members, and the demand must be met through some medium. Probably, the inquiries for the book have been prompted by the realization that only by virtue of an authoritative presentation of this kind will we be able to cope with the avalanche of proprietary

products, the numbers of which are increasing rather than decreasing.

The chief function of the Council is to protect the profession and the public against the inroads of unworthy or worthless preparations that are constantly being forced on the people, and the surest way of checkmating this is to have a reliable list of drugs available for ready distribution which a dentist may have access to at a cost of a dollar or two.

The demand for this publication was expressed at the recent meeting of the American Association of Dental Schools, where the sections on materia medica and therapeutics went on record as recommending the publication of such a volume. From various sources, similar requests are coming in, and the only problem that arises is one of ways and means.

The insistent question of the hour is: How can this laudable enterprise be financed?

LIMITED SPACE

There are two kinds of items that are constantly being sent to THE JOURNAL for publication that manifestly cannot be used, and it would save much disappointment if they were withheld. One relates to resolutions passed by societies on the death of leading members of the profession or other prominent citizens, and the other to notices of coming meetings of a purely local character such as alumni clinics, or of small organizations having no relation to national affairs in any way.

If we attempted to use all of the items of this character that are being sent in, we would have little space for anything else, and we are thus reluctantly obliged to omit them. To acknowledge the receipt of all of these notices individually and explain why they cannot be used has become too great a tax on editorial endurance; which accounts for this notice.

Another matter that should be mentioned is this: In forwarding notices of meetings, some secretaries write "Repeat this notice

every month till the date of meeting," not realizing the amount of space that this would take if all these requests were honored. The solution is to publish the notice one month and then place the society with date of meeting in the calendar each month till the meeting is held. This serves the purpose without the consumption of too much space. A little consideration and cooperation will aid THE JOURNAL without detracting from its efficiency.

THE BANE OF REJECTED MANUSCRIPTS

If there is anything more irksome than another in connection with editing a magazine it is the necessity for returning a manuscript to the author after it has been submitted for publication. It is usually interpreted as a slap in the face, and that is the thing furthest from an editor's intention. There are so many reasons that a manuscript may not be available aside from any question of merit or lack of merit. A manuscript may be a masterpiece and yet not fit into the requirements of a particular publication, though it should be said (in the strictest confidence) that a masterpiece always makes the editor itch to stretch a point and accept the article regardless of its suitability for a certain publication. Masterpieces are so very rare. To reject one seems much like throwing away a nugget of pure gold.

Usually, the reason for returning a manuscript is the fact that there are only a certain number of pages to fill, and when these are filled, there is nothing for the editor to do but return the surplus. And this one fact should be emphasized, though it is seldom realized: the necessity for rejecting a manuscript causes as much pain to the editor as it does to the author. If the editor could have his way there would be no rejected manuscripts except—but possibly we had better have no exceptions.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list of Accepted Dental Remedies. The Council desires to point out that admission of an article does not imply a recommendation. A copy of the rules which govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

PYRIDIUM. — Phenylazo-2-6-diamino-pyridine monohydrochloride. — Phenylazo-α-α-diamino-pyridine monohydrochloride. $C_5H_5N{:}N\ C_5H_2N\ (NH_2)_2(2)(6)\ HCl$. The monohydrochloride of an azo dye of the pyridine series, phenylazo-α-α-diaminopyridine. Pyridium contains 28 per cent of nitrogen.

Action and Uses.—Pyridium is said to be bactericidal in aqueous solution against staphylococci, streptococci, gonococcus, *B. coli*, *B. diptheriae* and the spirochete and fusiform bacillus of Vincent's infection. Reports by a number of observers have indicated its usefulness in the treatment of infections due to the above-named organisms. This dyestuff imparts an intense redness to tissues and dressings and when absorbed in sufficient quantities even from the oral mucosa will tinge the urine. Although the clinical evidence for its use in dentistry is fragmentary, it is maintained that the local application is beneficial in the treatment of postoperative and traumatic lesions, and for use in sockets after extractions and in ulcerative processes.

Pyridium has some penetrating power and is nontoxic and nonirritating in therapeutic dosage when taken internally.

Dosage: For local application, pyridium may be applied in an aqueous solution of 0.5 to 1 per cent, or pyridium ointment up to 10 per cent may be used. It is suggested that it may be applied as a paste consisting of a mixture of pyridium powder and pyridium solution in the desired consistency. For application directly to fistulas, a 0.5 per cent solution may be used.

Pyridium should not be used in connection with compounds containing mercury as it releases the mercury from such compounds. Its use is contraindicated when uremia and severe disorders of the kidneys of a noninfectious type are present.

Pyridium is only slightly soluble in cold water, about 1 part in 300. It will form supersaturated solutions relatively easily. Pyridium will precipitate out of a 2 per cent (supersaturated) solution after approximately two days; it will precipitate out of a 1 per cent solution only after months. A 1 per cent solution may be stabilized for months by the addition of 10 per cent dextrose, U. S. P. X. Aqueous solutions should be prepared with distilled water, as the salts present in the tap water of many localities are

liable to precipitate the free base phenylazo-α-α-diaminopyridin.

Manufactured by the Pyridium Corporation of New York (Merck & Co., Inc., distributor), U. S. patents Re. 17,281 (April 23, 1929; expires 1946), 1,680,109 (Aug. 7, 1928; expires 1945). U. S. trademark 251,253.

Aqueous Solution of Pyridium, 1 per cent: Pyridium, 1 gm.; anhydrous dextrose, 10 gm.; distilled water to make 100 c.c. This is a supersaturated solution. Any deposit appearing may be redissolved by warming.

Pyridium Ointment, 10 per cent: Pyridium, 10 per cent; wool fat, 77.5 per cent; expressed oil of almond, 12.5 per cent.

Pyridium Tablets, 0.1 gm.

Pyridium occurs as a red, odorless, microcrystalline powder, possessing a slightly bitter taste; slightly soluble in cold water, about 0.3 part in 100 parts; soluble in boiling water, about 5 parts in 100 parts, slightly soluble in alcohol, soluble in glacial acetic acid and glycerin; insoluble in acetone, benzene, chloroform, ether and toluene. These solvents, if not entirely free from water, may become yellow on the addition of pyridium. The aqueous solution (1 in 500) is red and is distinctly acid in reaction when measured by means of the hydrogen electrode. On addition of diluted sulphuric acid or a dilute solution of sulphates to an aqueous solution of pyridium a precipitate forms.

Methods of assay and tests of identity may be found in New and Nonofficial Remedies, 1931, page 152. (Note: Pyridium has been accepted by the Council for a period of one year. At that time, the new evidence which develops may be reviewed for further action.)

STOCK SOLUTIONS AND MIXTURES FOR LOCAL ANESTHESIA

Inquiries have come to the Council from dentists concerning stock solutions of preparations for local anesthesia. Many of these queries were prompted by discussion centering around alkaline solutions for this purpose.

The Council therefore requested a consultant of the Council to review the situation with a view to presenting the findings to the profession. The Council has concurred in the conclusions of the consultant and has authorized the publication of the following preliminary report as one in its series on pharmacology and therapeutics.

SAMUEL M. GORDON, *Secretary.*

Various products are in daily use in practically every dental office and operating room for obtaining local anesthesia by hypodermic injection. Consequently, a consideration of the materials and of the manner of marketing are important, since the practitioner relies solely on general impressions of results obtained in judging products used for this purpose. Should there be complications or unsatisfactory results, he has no reliable method of determining whether the product used, the method employed or the idiosyncrasy of the patient is the source of the unfavorable consequences. On this account, it is incumbent on dentists to know exactly what they are using.

Many drugs and combinations of drugs have been employed by the dental and medical professions for local anesthesia. The drug which has received the most attention and has been used almost universally in recent years is procain hydrochlorid, which may be used alone but is generally employed in combination with epinephrin. The reasons for this universal selection are now common knowledge. Procain hydrochlorid, epinephrin and solutions of epinephrin hydrochlorid are official in the

tenth edition of the United States Pharmacopeia. For many years, solutions for local anesthesia were prepared by the operator or an assistant, either by adding tablets or procain hydrochlorid and epinephrin of desired composition to the required volume of sterile water or physiologic sodium chlorid solution; or by making a small amount of stock solution of procain, and adding epinephrin to the solution just before making the injection.[1]

Stock solutions prepared in bottles of different sizes, usually large ones, were introduced frequently under proprietary names, which, in general, were noninforming as to the exact composition, such as "Dr. So-and-So's Local Anesthetic" instead of a name that would indicate at once the essential composition of the solution. Some of these names persist, but a discussion of this is beyond the scope of this article. Such solutions were not generally satisfactory because proportionately large amounts of preservatives were used, and the permanent stability and sterility of such stock solutions were open to question. The rationality of injecting some of the constituents used as "bases" or preservatives or for "sterilization" is still unsettled. This applies to glycerol, phenol, naphthol, guaiacol carbonate and other coal tar derivatives, iodin, essential oils, etc., when sterilization may be obtained by less objectionable and more rational methods.

Later, these prepared stock anesthetic solutions were offered to the professions in sealed glass ampuls and in rubber-stoppered containers of the cartridge type. These cartridges have been designated by trade marked names, such as "anestube" and "carpule." These were first introduced about ten years ago. The different dosage forms of procain and epinephrin of various manufacturers were designated by numbers or letters. Here too, some chemical or a mixture of chemicals was added to stabilize or to preserve the solution. Of these adjuvants, chlorbutanol (chloretone) may be considered the least objectionable because it possesses mild anesthetic properties and is useful as a preservative for solutions intended for injection.

The style of container, as well as the specific stabilizer or preservative employed, was the advertising feature of individual firms, although the basic drugs, procain and epinephrin, were presumably the same. One advantage claimed for these products was the circumstance that each container was used for one patient, and the disadvantages inherent in the stock solution where used for several patients were eliminated. This may have been more fanciful than real, for reasons described later on. The appeal to the dentist was based principally on the time saved by using such stock mixtures, and, at present, a considerable portion of the procain administered by dentists is marketed in this way. Any claims to the effect that better and longer acting anesthesia is produced by using these package forms are misleading. The marketing of anesthetic solutions in such containers has in general serious disadvantages. Some of them contain preservatives with potential irritating properties, and the solutions may be more acid than is desirable, as recent investigations indicate.[2] The

1. Fischer, Guido: Local Anesthesia in Dentistry, Ed. 3 (American), Philadelphia: Lea & Febiger, 1923, pp. 54-74. Gwathmey, J. T.: Local Anesthesia as Applied in Dentistry, Ed. 3, New York: The Macmillan Company, 1929.

2. Freeman, C. W., and Benedict, H. C.: Preliminary Report of Continued Investigations of Local Anesthetics with Special Reference to Buffered Solution of High pH Value, Bull. Chicago D. Soc., 10:3-6 (Aug. 8) 1930.

stability of such solutions even when acid is doubtful if they are kept long or are exposed to heat, light, etc. Additional data on these matters are desirable.

Decomposition of epinephrin is accelerated by an alkaline reaction. It has been known for some time that a solution of procain hydrochlorid and epinephrin is more stable in an acid than in an alkaline medium. This has led manufacturers of these ampul or cartridge forms to market solutions with a relatively higher concentration of acid (low p_H), the p_H usually ranging between 3.3 and 5.5, which represents a higher degree of acidity than that of the fluids and tissues of the body.[2] More recently, investigators have again urged the desirability of using local anesthetic solutions which in reaction more nearly approach the blood and tissues.

It is claimed for these solutions that anesthesia is more rapidly produced and less local tissue injury is caused, because the chemical reaction of the solution does not have to be neutralized at the expense of the body fluids, and tissues. The extent to which this effect is of major clinical importance is not entirely settled.

It was noted as early as 1910 that the addition of sodium bicarbonate increases the efficiency of local anesthetics two to four times for direct application or injection into nerve trunks and probably also for an application to mucous surfaces.[3] Later, an anonymous writer again suggested the use of an alkaline solution,[4] stating that a suitable alkaline solution of p_H 9.1 is obtained by dissolving 6.94 gm. disodium phosphate (Na_2HPO_4) and 6.44 gm. sodium chlorid (NaCl) in 1,000 c.c. of water. At the Hamburg (Germany) Dental Institute, of which Dr. G. von Fischer is director, the acid solutions have been replaced by alkaline solutions for local anesthesia. In a recent paper, Fischer reviewed the apparent disadvantages of a solution with an acid reaction and advised the use of a solution of disodium phosphate as a vehicle for mixtures of procain and epinephrin.[5] Fresh solutions are recommended in most reports on this subject. (It is desirable to note that Ringer's solution, commonly referred to as a balanced solution, has the following qualitative composition: sodium chlorid, potassium chlorid, calcium chlorid, and sometimes sodium bicarbonate. Different workers have devised several different quantitative formulas.[6] This solution is adapted for physiologic experiments on frogs. Locke's and Tyrode's solutions, of somewhat different composition, are adapted for physiologic experiments on mammals.[7] The so-called Ringer's solution of dentistry has the following composition: sodium chlorid, 0.5 per cent; potassium chlorid, 0.02 per cent; calcium chlorid, 0.04 per cent. It is stated that this solution does not cause any change in the tissues after injection. It would be more appropriate to speak of this solution as Ringer's solution modified for dental injection. Solutions differing qualitatively from the original Ringer's solution should not be referred to as Ringer's solution, without specifying the exact composition.)

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3. Sollmann, Torald: Manual of Pharmacology, Ed. 3. Philadelphia: W. B. Saunders Co., 1926, p. 328.

4. Klin Wchnschr. 28, 1928; Pharmaceut. J. (London) 122:57, 1929; through Year Book 1929, Am. Pharmaceut. Assn., p. 61.

5. Fischer, Guido: Preparation of Local Anesthetic Solution, Klin. Wchnschr., 7:1838-41 (Sept. 16) 1928.

6. Sollman, Torald, and Hanzlik, P. J.: Physiologic Salt Solutions in Experimental Pharmacology, Philadelphia: W. B. Saunders Co., 1926, p. 300-303.

7. Footnote 3, p. 806.

In this connection, it is necessary to emphasize the desirability of using only freshly prepared alkaline solutions of local anesthetics. No adequate evidence of a quantitative nature is readily available to indicate the stability of the alkaline solutions which are marketed, and practitioners should bear in mind that the clinical use of alkaline stock solutions is in the experimental stage. For this purpose, many potentially alkaline salts may theoretically be used, such as the "sodium phosphates" alone or in mixtures or sodium bicarbonate, with or without sodium chlorid. One alkaline solution which has been suggested may be conveniently prepared as follows:

The simplest, and one of the most effective alkaline solutions is the following: 1 gm. of sodium carbonate in 1 liter of distilled water (this makes a 0.1 per cent solution).

(A solution of sodium carbonate alone, even dilute, should not be injected into the tissues because it is irritating and causes sloughing. Five cubic centimeters of the solution of the concentration mentioned and used as described below, for each tablet containing 0.1 gm. [1½ grain] procain hydrochlorid, is less than the amount required to liberate all the procain base, thus: $Na_2CO_3 + 2P.HCl \rightarrow 2NaCl + 2P + H_2O + CO_2$, thereby removing the potential irritation of the original sodium carbonate used for alkalinizing. The amount of sodium carbonate is enough to liberate only about one-fourth of the procain base. Therefore, the injection solution contains procain base, procain hydrochlorid and sodium chlorid. The sodium carbonate may be replaced by an equivalent amount of sodium bicarbonate U. S. P.)

This is placed in a flask with a cotton stopper and boiled thoroughly, and is used as the vehicle. Small amounts as desired are placed in a small vessel, and the usual procain epinephrin tablets added as they have been in the past to plain water or "Ringer's Solution." This gives a procain solution with a p_H of about 7.8 which should give operative anesthesia in about one-third the time usually allowed for ordinary procain solutions. This solution must be used soon after made, as it is not stable when the procain is added, and begins discoloration within about an hour.

Procain borate, used exactly like procain hydrochlorid (without the alkali, since in solution the borate itself gives an alkaline reaction), is equally efficient, and has been used in some clinics.

A convenient way to prepare the solution for injection is by sterilizing the vehicle in individual amounts in test tubes in a special rack described elsewhere. Into each test tube 5 c.c. of the vehicle is measured and the entire rack and tubes are placed in the autoclave, and by keeping the cotton stoppers in the mouths of the tubes it remains sterile and ready for use, with only the addition of the tablet just before it is injected.[8]

Some manufacturers are marketing ready-made anesthetic solutions with a higher alkalinity. As might be expected, the addition of alkaline salts to stock solutions also decreases their stability. Attempts are being made to overcome this difficulty by adding stabilizers to prevent the oxidation (anti-oxidants) of the epinephrin and the procain in solution. The full clinical actions, including advantages and disadvantages of agents new to local anesthesia, should be studied as carefully as the anesthetic efficiency. To date, this has not been entirely achieved. The difficulties incident to the manufacture and distribution of a satisfactory stable sterile local anesthetic solution in a convenient container are many. If all the difficulties can

8. Freeman, C. W.: Studies in Local Anesthetics—Report on Clinical Use of Ethocaine Borate in Dental Practice, D. Cosmos, 71:949 (Oct.) 1929. (This article describes the special rack.)

be overcome and a product or products dispensed in convenient form and satisfactory in all respects, the profession will welcome the achievement. In the meantime, those desirous of adopting alkaline solutions of local anesthetics may use the method outlined above, which has the advantages of simplicity and ease of manipulation.

Conservative authors do not favor stock solutions in ampuls, and it may be assumed that they would object also to rubber-stoppered cartridges. Hospitals and general surgeons almost without exception favor freshly prepared solutions for local anesthesia.[9] Hence, collective experience should not be disregarded until something more satisfactory is found.

Generally, tablets containing local anesthetics marketed by reputable manufacturers may be regarded as satisfactory, but the exact composition must be known at all times. When brought into solution carefully, these tablets should, as a rule, give unvarying results. A solution in distilled water made from procain hydrochlorid and then sterilized can safely be employed as a stock solution for a limited time, the epinephrin being added at the time of operation. Large bottles of stock solutions distributed by manufacturers, even if the essential ingredients meet the accepted standards, are not considered satisfactory because of their uncertain stability and sterility. Sealed glass ampuls marketed by reputable manufacturers and containing only recognized and accepted ingredients, may, for the present, be considered satisfactory within certain periods after filling. It would be well if manufacturers were required to put on the label the date of filling of ampuls and cartridges. It would also be well for practitioners to acquaint themselves with the detailed composition of such solution, especially in view of discussions on new vehicles for local anesthesia agents and their marketing. Unless a detailed statement of composition prominently appears, the practitioner has no way of knowing whether he is using the same solution under the same trade name, at different periods. Reference to the Council on Dental Therapeutics should be of assistance in this respect. An inquiry directed to the Secretary will bring the information as to whether the essential information has been made available.

Rubber-stoppered containers, i. e., cartridges, made to fit special syringes, may, for the present, be accepted under the same conditions as the sealed glass ampuls. The acidity and possibly the presence of heavy metals resulting from the interaction of the liquid on the rubber of such solution is worthy of further study. The constituents employed as preservatives should come within definite limitations. The burden of proof of harmlessness, the rationality of the composition and the desirability of preservatives should be placed squarely on the manufacturer, and not on the dentist. In other words, the manufacturer should be expected to do his own experimentation before offering therapeutic products to the profession and expecting them to pay for the experimentation with their time, money and, possibly, reputation, let alone the public and its share.

In view of the possible absence of sterility for the ready-made solutions in ampuls or cartridges, it would be desirable to examine by bacteriologic methods, from time to time, these products purchased on the open market. It goes without saying that users of these ready-made products should assure themselves of the surround-

9. Bevan, A. D.: Present Status of the Anesthesia Problem, J. A. M. A., 97:1530 (Nov. 21) 1931.

ings in which, and of the methods by which, package preparations for local anesthesia are manufactured. It does not necessarily follow that a container which was put up in a sterile condition in the manufacturer's establishment is sterile at the time of use by the dentist.

In summary, it may be said that recent experiences point to the desirability of using freshly prepared alkaline solutions of procain hydrochlorid and epinephrin for local anesthesia. Stock solutions in bottles, ampuls or cartridges are not without objection. The burden of proof rests upon those who would claim the contrary.

BUREAU OF CHEMISTRY

MORE MISBRANDED DENTAL NOSTRUMS

VIDENT NO. 4 POWDER FOR RIGGS' DISEASE, AND VIDENT NO. 6 RIGGS' DISEASE MOUTH WASH

ABOUT October, 1930, Katz & Besthoff shipped from New Orleans, La., into the State of Texas, a quantity of Vident No. 4 Powder for Riggs' Disease, and Vident No. 6 Riggs' Disease Mouth Wash, which the Government declared was misbranded in violation of the Food and Drugs Act as amended, because the articles were not "antiseptic" or "germicidal" and the following statements were false, fraudulent and misleading: "Riggs' Disease Powder an adjunct to Vident Rigg's Disease Mouth Wash . . . and assists the recovery of gums"; and for the mouth wash: "Riggs' Disease Mouth Wash is invaluable for all forms of Stomatitis, Gingivitis, Salivation and Aphthae and is a great aid in the treatment of Pyorrhea Alveolaris."

Analysis of Vident No. 4 Powder for Rigg's Disease showed that it consisted essentially of pumice, calcium carbonate, sodium bicarbonate, sodium chlorid and boric acid, with small proportions of a phenolsulphonate, menthol and thymol. The article was not antiseptic.

Analysis of Vident No. 6 Riggs' Disease Mouth Wash showed that it was a brown solution containing chiefly water, alcohol, (20 per cent) glycerin potassium iodid, boric acid, zinc chlorid and iodin, together with small amounts of formaldehyd, thymol and eucalyptol.

In March, 1931, Katz & Besthoff (Ltd.) appeared as claimant for the property and admitted the essential allegations of the libel. A decree was entered ordering that the product be delivered on payment of costs and the execution of a bond conditioned in part that they should not be sold or otherwise disposed of contrary to law. (Notice of Judgment 18301, issued, January, 1932.)

PYROS

In April, 1930, the Pyros Company, Denver, Colo., shipped from the State of Colorado into the State of Washington a quantity of Pyros, which the Government declared was adulterated and misbranded, stating that the article was not antiseptic or germicidal.

Some of the statements which appeared on the labeling were: "A perfect Antiseptic . . . Pyros is an ideal antiseptic mouth wash, for it has a definite selective action on disease germs in the mouth."

It was also alleged that the following statements regarding the curative and therapeutic effects were false and fraudulent. The following appeared on the labeling: "Pyros for Pyorrhea . . . Prevents Contagious Diseases . . . Arrests Decay—Arrests Pyorrhea. For sore, tender, ulcerated gums, loose teeth and Pyorrhea infections in general. Stops tartar . . . Pyros makes Healthy Mouths . . . Pyros Penetrates. Pyros makes clean, healthy saliva, nature's mouth wash. The definite and selective germicidal action of Pyros stops the bacterial acid detrition in the first stages of tooth decay. It is agreed by scores of dental Scientists, Pyorrhea Specialists and Oral Surgeons that never in the life of the world has there been anything to equal the merit of Pyros for stopping or preventing Pyorrhea, Trench Mouth and other oral afflictions. You may conscientiously and ethically recommend Pyros to prevent or arrest both decay and Pyorrhea."

Analysis of the product showed that it consisted essentially of compounds of zinc, sodium, ammonium and aluminum, sulphates, chlorids, glycerin and water, and the article was not antiseptic or germicidal.

In May, 1931, judgment of condemnation and forfeiture was entered, and the Court ordered that the product be destroyed. (Notice of Judgment 18207, issued October, 1931. See also Notice of Judgment 17874, issued, June, 1931.)

STYPSTRINGANT

In December, 1930, the Lawrence Chemical Company, Atlanta, Ga., shipped from Georgia into Florida a quantity of Stypstringant which the Government declared was misbranded.

It was alleged that the article was misbranded because the antiseptic claims were false and misleading, and because curative claims for pyorrhea, and for "Soft-Bleeding, Spongy Receding Gums and Loose Teeth . . . and . . . in all severe inflammation of the gums . . ." were false and fraudulent.

Analysis showed that the product consisted essentially of potassium iodid, formaldehyd, extracts of plant drugs, including tannin, and water.

The article when diluted as directed was not antiseptic.

In January, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18210, issued, October, 1931.)

LU-ORA

In June, 1930, Stevens Luke Company, Thomasville, Ga., shipped from Georgia into the State of Florida, a quantity of Lu-Ora, which the Government declared was misbranded and adulterated in that the product was not germicidal and that the statements in the labeling regarding the curative and therapeutic effects in pyorrhea, mouth ulcers, trench mouth or stomatitis were false and fraudulent.

In April, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18214, issued, October, 1931.)

NO. 7 ALKALINE AND ANTISEPTIC TABLETS

About February, 1931, John Wyeth & Bro. (Inc.), Philadelphia, Pa., shipped from Pennsylvania into the State of New York a quantity of No. 7 Alkaline and Antiseptic Tablets, which the Government declared was adulterated, in that the product was not antiseptic in the solution recommended, and misbranded in that the statements on the labeling regarding the curative and therapeutic value "in cases of stomatitis and retraction of the gums" were false and fraudulent.

Analysis of the article showed that it consisted essentially of sodium chlorid, sodium salicylate, sodium benzoate, sodium bicarbonate, sodium borate and small proportions of menthol, thymol, eucalyptol and methyl salicylate.

In April, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18215, issued, October, 1931.)

GUM RUB

In December, 1930, Gum Rub, Inc., Washington, D. C., shipped from the District of Columbia into the State of New York a quantity of Gum Rub, which the Government declared was misbranded in that statements regarding the curative and therapeutic effects of the article in the treatment of "Pyorrhea and Lesser Gum Disorders," were false and fraudulent.

Some of the statements which appeared in the labeling were: "A Home treatment for and in prevention of Pyorrhea and its forerunners — receding, bleeding, tender and flabby gums, gum ailments, concurrent with pregnancy . . . gingivitis; for starved or undernourished gums. To revitalize the circulation, as a toner. . . . Gum Rub maintains health and vigor in the gums; Gum Rub is a scientific treatment of mechanico-therapy value in pyorrhea and its forerunners . . . in cases of marked recedence of gums . . . the quantity of Gum Rub should not be cut down if it is hoped to overcome this gum disease and avoid pyorrhea."

Analysis of the article showed that it consisted essentially of sulphur (21.6 per cent), glycerin, gum and water, flavored with peppermint oil.

In April, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of judgment 18217, issued, October, 1931. See also Notice of Judgment 18321, issued, January, 1932.)

GILBERT'S ORAL ANTISEPTIC

About March, 1931, the Gilbert Products Corporation, Morristown, N. J., shipped from New Jersey into Pennslyvania a quantity of Gilbert's Oral Antiseptic, which the Government declared was misbranded in that the following statements in the circular accompanying the article were false and misleading: "When diluted it forms a non-germicidal solution which retains the penetrative and stimulating powers of the PMG and in this form the globules of PMG adhere to the delicate tissues and after penetration stimulate a . . . mild antiseptic action. . . . Dentists using con-

centrated PMG in the treatment of Pyorrhea will prescribe the strength of Gilbert's Oral Antiseptic desired for your particular case. . . . For specific conditions such as sore throat, tender gums . . . as a safeguard against infection . . . indicated in the treatment of tender and bleeding gums . . . and as prescribed by the dentist for Gingivitis, Pyorrhea and Vincent's Infection . . ."

In April, 1931, notice of condemnation and forfeiture was entered, and the court ordered that the product be destroyed. (Notices of Judgment, 18221, 18222, issued, October, 1931.)

DR. A. PETERS' TUBEROSUM PYORRHEA TREATMENT

About November, 1930, the Tuberosum Pyorrhea Company, Broken Bow, Okla., shipped from Oklahoma into the State of Texas a quantity of Dr. Peter's Tuberosum Pyorrhea Treatment. The preparations came in a bottle which, on analysis, was found to consist of essentially acetic acid, salicylic acid, a small proportion of phenol, starch and water, flavored with cinnamon oil and coumarin.

The Government declared that the article was misbranded in that the claims regarding the curative and therapeutic effects of this article in pyorrhea were false and fraudulent.

Some of the statements in the labeling upon which the Government based its allegations were: "This preparation is a Preventive and Treatment . . . I think your medicine is the greatest cure for Pyorrhea that I ever saw. I shall always keep it."

In March, 1931, judgment of condemnation and forfeiture was entered, and the court ordered that the product be destroyed. (Notice of Judgment 18225, issued, October, 1931.)

DR. PIRTLE'S GERM OIL

About November, 1929, the Germ Oil Company, Jonestown, Miss., shipped from Mississippi into the State of Tennessee, a quantity of Dr. Pirtle's Germ Oil, which the government declared was misbranded in that the following claims were false and fraudulent: "Germ-Oil the Great Remedy for the Kidney, Bladder and Stomach Troubles . . . For all pains about the body, Backache, Side-pleurisy . . . Toothache, Headache or any Neuralgia or Rheumatic Pains . . . Blood Purifier . . . Sore on Man or Beast . . . For Private Disease or Lost Manhood . . . Rheumatism."

Analysis by the Government chemist showed that the article consisted essentially of a nonvolatile oil, turpentine oil and sulphur.

In May, 1931, judgment of condemnation and forfeiture was entered and the court ordered that the product be destroyed. (Notice of Judgment 18325, issued, January, 1932.)

PYRO SANA TOOTH PASTE

About November, 1930, the Alhosan Chemical Company, St. Louis, Mo., shipped from the State of Missouri into the State of Tennessee a quantity of Pyro Sana Tooth Paste which the Government declared was misbranded.

When analyzed, the product was found to consist of a pasty mass containing calcium carbonate, glycerin and a small proportion of creosote.

The Government declared that the claims that this preparation would prevent pyorrhea and preserve the gums, and that it was a proven medical agent in checking and controlling pyorrhea and soft bleeding gums and preventing receding of the gums and making them hard and firm, were false and fraudulent.

In May, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 19329, issued January, 1932. See also Notice of Judgment 17968, issued, June, 1931.)

SOZODONT LIQUID

About May, 1930, the Block Drug Company, Brooklyn, N. Y., shipped from New York to California a quantity of Sozodont Liquid which the Government declared was misbranded. The liquid came in bottles, and on analysis was found to consist essentially of borax, sodium salicylate, saccharin, volatile oils, including menthol and methyl salicylate, soap, glycerine, alcohol, and water colored with a red dye. The article was not antiseptic.

The Government alleged that the article was adulterated and it was further declared that the claims "Sozodont Liquid is a good medium for use in massaging the gums" and "The gums should be thoroughly massaged to reduce the chances of Pyorrhea" were false and fraudulent.

In July, 1930, notice of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment, 18334, issued, January, 1932.)

DR. E. A. WELTER'S ANTISEPTIC TOOTH POWDER

About October, 1930, the E. A. Welters Tooth Powder Company, Jacksonville, Fla., shipped into the State of Tennessee a quantity of Dr. E. A. Welter's Antiseptic Tooth Powder, which the Government declared was misbranded.

A sample on analysis was found to contain essentially calcium carbonate, soap and small proportions of ammonium alum and volatile oils, including peppermint oil. The article was not antiseptic.

The product was declared misbranded because the following claims regarding the curative and therapeutic effects of the article were false and fraudulent; namely, "Dr. Welter's Antiseptic Tooth Powder Heals and Hardens Bleeding Gums. This dentifrice is universally recognized as the most efficacious preparation known to dental science for Healing and Hardening Tender and Bleeding Gums. . . . The first symptoms or signs of pyorrhea are 'bleeding' and 'irritated' gums, which should be corrected immediately by consulting a dentist and using Dr. Welter's Antiseptic Tooth Powder, which is specially prepared for Healing and Hardening Bleeding Gums. . . . Prevents Decay . . . By removing the constant germ formation from the teeth by the use of "Dr. Welter's Antiseptic Tooth Powder" applied with a good tooth brush, morning, noon and before retiring . . . It is prepared specially for Preventing Pyorrhea, Healing and Hardening Bleeding Gums," which the Government declared were false and fraudulent, since no ingredient or combination of ingredients capable of producing the effects claimed were present.

In May, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18335, issued, January, 1932.)

CHLORAX

About August, 1929, the Chlorine Products Company, Primos, Pa., shipped from Pennsylvania into the State of Tennessee, a quantity of Chlorax, which the Government declared misbranded, in that the curative claims ". . . of great value in the treatment of pyorrhea," among others, were false and fraudulent.

Analysis by the Government chemist showed that the product consisted essentially of calcium hypochlorite, lithium chlorid, a small proportion of mercuric chlorid, a trace of alkaloid and water.

In May, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18336, issued, January, 1932.)

CATO ANTI-PYORRHEA TOOTH PASTE

About January, 1930, the Cato Chemical Company, St. Louis, Mo., shipped from Missouri into the State of Tennessee a quantity of Cato Anti-Pyorrhea Tooth Paste, which the Government declared was adulterated and misbranded.

Analysis of the product showed that it consisted essentially of calcium carbonate, potassium chlorate, talc and a small proportion of a magnesium compound such as magnesium carbonate in a paste, flavored with volatile oils including peppermint oil.

The product was adulterated in that the article was not a germicide or antiseptic as claimed.

The following statements made in connection with the product were declared false and fraudulent: ". . . All diseases the Human System is heir to are caused by germs or microbes. Cato Anti-Pyorrhea Tooth Paste is a Germicide, Antiseptic," and the claims that it was "Anti-Pyorrhea" or for sore and bleeding gums or any pathological condition of the mouth or to prevent a healthy mouth from becoming infected, or the claim that it is "To harden sore, soft, spongy and bleeding gums . . ."

In May, 1931, a notice of condemnation and forfeiture was entered, and the court ordered the article destroyed. (Notice of Judgment 18353, issued, February, 1932.)

PAINALLAY

About January, 1931, the Painallay Co., Kansas City, Mo., shipped into the State of Kansas a quantity of Painallay which the Government declared was misbranded.

The liquid on analysis was found to consist of small proportions of a phenolic compound such as cresol, a benzyl compound and glycerin dissolved in water (98 per cent). It was alleged that the following curative and therapeutic claims were false and fraudulent: namely, "Relieves Pain . . . Beneficial in the treatment of . . . Pyorrhea, Trench Mouth or

Vincent's, Tonsilitis, etc. . . . For all mouth and throat infections . . . Painallay is exceedingly beneficial in the treatment of the following and other infections to give relief from pain . . . Pyorrhea and Inflamed Gums . . . Vincent's or Trench Mouth . . . beneficially efficient in the treatment of mouth and Throat infections and as a general prophylactic."

In May, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18357, issued, February, 1932.)

LUEBERT'S NOX'EM PAIN TABLETS

About September, 1930, A. Gustav Luebert, Coatesville, Pa., shipped into Delaware a quantity of Luebert's Nox'Em Pain Tablets, which the Government declared was misbranded.

Analysis showed the product to consist of 3.25 grains acetanilid, caffein, sodium bicarbonate, strychnin and starch.

The Government declared that the claims that this preparation would promptly relieve all cases of "Sick Nervous Headache, Sea or Car Sickness, Ovarian Pains, Painful Menstruation, Toothache, Faceache, Backache, Rheumatic Pains and Grippe . . ." and ". . . They stop nerve pains such as neuralgia of the head, face, neck and back, including toothache, faceache, earache and all pains located along the nerve tracts . . ." were false and fraudulent.

In April, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18363, issued, February, 1932.)

PYRADIUM

About August, 1928, the Radium Remedies Co., Minneapolis, Minn., shipped into Montana a quantity of Pyradium which the Government declared was misbranded.

Analysis of the article showed that it consisted essentially of zinc and sodium chlorids and sulphates, boric acid, glycerin, alcohol and water flavored with peppermint oil and colored green. It contained 5.5 millimicrograms of radium per milliliter, a therapeutically negligible proportion. The article, undiluted, would not destroy common disease-producing organisms within an hour.

The claims regarding the curative and therapeutic effects of Pyradium were declared to be false and fraudulent since it contained but 5.5 millimicrograms of radium per cubic centimeter, which amount is negligible as far as any therapeutic effects are concerned, and the claims that it was a "Pyorrhea Preparation. Kill the Germs. Heal the Gums. Save the Teeth"; and the "Technique of Treatment for Pyorrhea and Other Oral Infections by the Administration of Pyradium . . ." and "This bottle of Pyradium is guaranteed to relieve pyorrhea if used according to directions" were false and fraudulent. The reference to radium in advertising the preparation were also held to be false and fraudulent.

In May, 1931, judgment of condemnation and forfeiture was entered, and the Court ordered the product destroyed. (Notice of Judgment 18371, issued, February, 1932.)

LAVODENT

On three different occasions in 1930, the Lavodent Research Laboratories, Inc., Philadelphia, Pa., shipped into Delaware a quantity of Lavodent, which the Government charged was misbranded.

The product when analyzed was found to consist essentially of zinc chlorid, ammonium chlorid, saccharin and flavoring oils including cassia oil, and water. The article was not antiseptic.

The article was declared misbranded because the following statements were either false and misleading or false and fraudulent, since it was not antiseptic, and since the article contained no ingredient or combination of ingredients capable of producing the named effects: "Lavodent has an inhibitive action on these bacteria. . . . Is several times as powerful a germ killer as pure carbolic acid" and "Prevents Pyorrhea . . . Strengthens the gums . . . For Pyorrhea . . . use Lavodent with equal parts of hot water every four hours."

In April, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18372, issued, February, 1932.)

ANTI-PYOR MOUTH WASH

About March, 1931, Sharp & Dohme, Inc., Philadelphia, Pa., shipped from Pennsylvania into the State of New York a quantity of Anti-Pyor Mouth Wash, which the Government charged was misbranded.

Analysis of the product by Government

chemists showed that it consisted essentially of alcohol (42 per cent) zinc chlorid (1.78 grains per fluid ounce), small proportions of beta-naphthol, formaldehyd, menthol, methyl salicylate, extracts of plant drugs and water.

Misbranding was alleged in that the following statements on the labeling regarding the curative or therapeutic effects were false and fraudulent: "Anti-Pyor . . . valuable aid in the prevention and treatment of Pyorrhea Alveolaris . . . helps to heal erosions and hardens the gums . . . Anti-Pyor is used to . . . prevent decay of the teeth . . . inflammation, ulceration and receding of the gums, abscesses and pyorrhea . . . Anti-Pyor aids in safeguarding the region in which many ills find a starting point. By preventing trouble, Anti-Pyor helps materially in maintaining good health."

The product was declared misbranded in that the label did not declare a statement of the quantity of alcohol and that the amount of zinc chlorid and alcohol on the label were false and misleading.

In June, 1931, judgment of condemnation and forfeiture was entered, and the court ordered the product destroyed. (Notice of Judgment 18375, issued, February, 1932.)

DR. HUFF'S COMBINATION TOOTH POWDER AND MOUTH WASH

About November, 1930, (Dr.) Huff's Tooth Powder Co., Hot Springs National Park, Ark., shipped into Tennessee a quantity of Dr. Huff's Combination Tooth Powder and Mouth Wash, which the Government declared was adulterated and misbranded.

Analysis of the article showed that the product consisted essentially of sodium bicarbonate, sodium chlorid, sodium borate, lactose and methyl salicylate, and that the article was not antiseptic.

The following curative and therapeutic claims for pyorrhea and other gum conditions; namely, "A reliable remedy for Gum Trouble and Specially Recommended for Pyorrhea . . . The Best Treatment for inflamed Gums and Pyorrhea . . . It should contain Chloride Sodium to preserve and harden the gums . . . For Sore, Spongy and Bleeding Gums Dr. Huff's Tooth Powder is an ideal Preparation and can be depended upon to give immediate relief and restore the soft tissues to a normal condition," were false and fraudulent.

In May, 1931, judgment of condemnation and forfeiture was entered, and the Court ordered the product destroyed. (Notice of Judgment 18386, issued, February, 1932.)

BUREAU OF PUBLIC RELATIONS

THE CINCINNATI MOUTH HYGIENE CAMPAIGN

FOREWORD

THE execution of a series of activities to focus public attention on the proper care of the teeth and mouth and the dissemination of information on this subject have been accomplished previously by many cities, including Cincinnati, where for twenty years educational work has been carried on. No originality is claimed for the methods employed in the mouth hygiene campaign recently concluded in Cincinnati. They are essentially those used in the promotion of many public movements. Any value attributed to this compilation is due to the application of these ordinary tools of promotion to the specific subject of mouth hygiene.

It is the opinion of the committee that if this campaign has been unusual, the unique features lie in the number of activities conducted, in the broad scope of appeal and in the economy of operation effected.

The outstanding feature is undoubtedly the active participation of the dentists themselves. At least 75 per cent of the members of the Cincinnati Dental Society contributed time and effort to the campaign, through talks to mothers' clubs and over the radio and examination of teeth and in committee activities. The committee believes that this is a record few cities could excel.

This report is made so that a record of the Cincinnati Mouth Hygiene Campaign may be available to other communities undertaking a similar work.

The report will include, first, a general statement of the organization, the committee organizations, the financial statement and copies of letters and other material in the general plan. Following this, the work of each committee will be presented, including copies of important material.

Indebtedness to the Cincinnati Dental Society for this contribution is acknowledged. Because of the large amount of information presented, the article will be published in installments. It is believed to be the most nearly complete paper on the development of a mouth hygiene campaign that has been published. The information which it contains should prove of great value to workers in all parts of the country.

NOTE OF EXPLANATION

Two organizations peculiar to Cincinnati will be mentioned frequently in this report, the Mouth Hygiene Council of the Public Health Federation and the Public Dental Service Society.

The Public Health Federation is the health department of the Cincinnati and Hamilton County Community Chest. It is the organization which coordinates the work of all public and private agencies concerned with health. Its work is carried on through twelve councils. One of them, the Mouth Hygiene Council, has a membership of forty representatives of agencies, institutions and associations carrying on any form of dental work. The

council meets once a month and serves as a clearing house for problems relating to dentistry and mouth hygiene in Cincinnati.

The Public Dental Service Society is a committee of the Cincinnati Dental Society which is responsible for the dental program in the public schools. The society has a staff of three full-time, seven half-time and one quarter-time dentists; six full-time dental hygienists; nine full-time and one half-time dental assistants, an executive secretary and supervisor on half-time and a chief dental assistant. There are five curative chairs stationed in well-located public schools, a vocational bureau examining clinic, a part-pay clinic for children above the third grade and for the vocational bureau and a clinic at the crippled children's school. The dental hygienists carry on a continuous program of examinations and education.

ORGANIZATION AND GENERAL PLAN

At the regular May, 1931, meeting of the Mouth Hygiene Council of the Public Health Federation, Dr. Henry German presented a proposal that the Mouth Hygiene Council promote a week of intensive mouth hygiene education. The idea was suggested by Dr. L. G. Bean (now deceased), director of dental hygiene in the Ohio State Department of Health. It was Dr. German's opinion that since Cincinnati is fairly well organized along the lines of mouth hygiene, they could very well set an example for the state by carrying out this suggestion of Dr. Bean's.

After discussion, members of the Council agreed that an educational campaign, to be effective, should extend over a longer period than one week. It was agreed therefore, that a campaign should be inaugurated in September, 1931, closing with a week of intensive work at some suitable date, preferably in early March. The proposal was adopted in this form by the Council, and the chairman was instructed to appoint a committee to meet with a group from the Cincinnati Dental Society and the Public Dental Service Society to ask their approval and a contribution. Both organizations approved the subject and agreed on the week of February 28-March 5 as the week of intensive work. This joint committee of representatives suggested the name of a dentist to serve as general chairman, and the appointment was duly made by the chairman of the Mouth Hygiene Council. The secretary of the Mouth Hygiene Council was appointed secretary for the campaign and all clerical work was done in the office of the Public Health Federation, except the work for the speakers' bureau and high school examinations, which was done in the office of the Public Dental Service Society. The general chairman appointed various committees to carry out the several activities that were agreed on. The general plan of organization was as follows:

The General Committee was made up of Drs. Carlos H. Schott, general chairman; Dr. H. J. Niedhamer, vice-chairman, and Dr. William Vosseler, treasurer; and Miss Anna M. Drake, secretary; ex-officio: Drs. William Vosseler, president, Cincinnati Dental Society; A. H. Fulkerth, president, Cincinnati Public Dental Service Society; H. J. Niedhamer, chairman, Mouth Hygiene Council, and Henry German, member of the Mouth Hygiene Council.

Radio was in charge of Dr. E. H. Jones, chairman. The Speakers' Bureau consisted of Drs. E. H. Jones, chairman, J. J. Wittenberg and E. J. Roche. Slides were in charge of Dr. H. C. Jarvis, chairman. Publicity was in charge of Drs.

Sidney J. Rauh, chairman, Carlos H. Schott and E. L. Ball, and Miss Anna Drake. County work was under Dr. E. H. Schoenling, chairman; Mr. C. H. Bennet, superintendent of county schools, and Mr. Bebee, county 4-H clubs.

The sub-committees were as follows: Newspaper: Dr. Leon Saks, Mr. Lewis Hillhouse, Mr. William S. Groom and Dr. Carl Wilzbach; Groceries: Dr. H. C. Jarvis; Drug Stores: Dr. J. J. Wittenberg; Vacant Stores: Dr. E. J. Roche. Special committees were: School Work: Dr. E. H. Jones; Boy Scouts: Dr. C. J. Hudson; High School Examinations: Dr. C. J. O'Donnell.

The following projects were adopted and assigned to various subcommittees and individuals: talks to mothers' clubs; newspaper publicity; programs in Y. M. C. A. and Y. W. C. A., talks to Girl and Boy Scouts; Camp Fire Girls; Girl Reserves and similar organizations; radio talks; a poster contest in the public and parochial schools; talks and motion pictures in schools; articles on mouth hygiene for house organs, club bulletins and suburban papers; educational programs in the waiting rooms of dental clinics and at the chair, with special attention to mouth hygiene in the regular class work or in special programs in schools. Members of the Speakers' Bureau of the Community Chest were asked to mention mouth hygiene in their talks on health subjects.

For the intensive campaign week, February 28-March 5, the following projects were planned: talks to service and civic groups, talks in high schools, radio talks, examination of teeth of all high school pupils, window displays and demonstration, intensive publicity and a display of prize posters.

The campaign, formally opened on September 12 with a public meeting attended by about 100 representatives of social and health groups. The speaker was Dr. Thaddeus P. Hyatt of the Metropolitan Life Insurance Company. One of the first items of publicity was a letter from President Hoover commending the Cincinnati organization for beginning a mouth hygiene campaign and wishing them success. Following are the letters used in calling attention to the above mentioned public meeting, also the letter received from President Hoover:

Members of the Cincinnati Dental Society:

The enclosed invitation is being sent to a list of 750 names, representing all fields of health and social work. You will, of course, want to do all you can to make this opening meeting of the Mouth Hygiene Campaign a great success.

If you know lay or professional workers in educational, health or social work who are, or who ought to be interested in mouth hygiene, will you not make an effort to get them to the meeting?

Sincerely yours,
C. H. SCHOTT, D.D.S., *Chairman,*
General Committee Mouth Hygiene Campaign.

Dear Friend:

The meeting to which we are inviting you is the opening gun of a six month campaign of mouth hygiene education. The campaign will include talks to mothers clubs, luncheon clubs, and other groups, newspaper publicity, radio talks, poster contests, school programs, window displays and other efforts to impress children and adults with the importance of healthy teeth and to furnish them with the essential facts of mouth hygiene.

Dr. Hyatt, who has come to Cincinnati to open the campaign, is particularly well fitted to perform this service because of his experience, his personality and his ability as a speaker. He is director of the dental division of the Metropolitan Life Insurance Company, an organization well known for its scientific as well as practical contributions to public health.

May we count on you to attend this luncheon and help us start the campaign off enthusiastically?

Children of the General Protestant Orphan

Asylum, an institution which has an excellent dental program, will demonstrate mouth hygiene.

Cordially yours,
C. H. SCHOTT, D.D.S., *Gen. Chairman, Mouth Hygiene Campaign Campaign Committee.*

You are cordially invited to attend a meeting, Saturday, September 12, at 12:15 p.m., at the Cincinnati Club. Thaddeus P. Hyatt, D.D.S., director of dental division, Metropolitan Life Insurance Co., will speak on "Mouth Hygiene a Vital Factor in Public Health Work." This meeting inaugurates a mouth hygiene education campaign under the auspices of the Cincinnati Dental Society, the Public Dental Service Society and the Mouth Hygiene Council of the Public Health Federation. Luncheon, $1.00. Please make reservations with operator—Parkway 3160.

I am interested to learn that the Cincinnati Dentists' Association is to conduct an educational campaign to promote oral hygiene. The Children's Charter, adopted by the recent White House Conference on Child Health and Protection, especially stressed the importance of prompt dental care of children. I wish you success in your efforts to improve the public health of both children and adults.

Yours faithfully,
HERBERT HOOVER.

The work was planned by months so that at the close of each month the program was checked to see that all the projects planned had been completed or were under way. Newspaper publicity included feature articles, a series, "Folklore or Science in the Care of the Teeth," notices of talks by dentists, announcement of committee meetings, report of progress of plans and several editorials. The layout of the campaign, arranged on a monthly basis, was as follows:

MOUTH HYGIENE CAMPAIGN
Plan by Months

September:
- Opening meeting with Dr. Thaddeus P. Hyatt
- Letter from President Hoover
- Begin talks to mothers' clubs
- Begin newspaper publicity
  - (*a*) Series on mouth hygiene
  - (*b*) Notices of talks by dentists
- Send letters to members of Speakers' Bureau, Community Chest
- Send letters of Y.W.C.A., Y.M.C.A., Boy and Girl Scouts, Camp Fire Girls, Girl Reserves, etc., to include mouth hygiene program
- First meeting of the Cincinnati Dental Society to be devoted to plans for campaign
- Talks and motion pictures in schools by representatives of Colgate Co. (3 months)
- Begin arrangements for poster contest
- Begin plans for radio talks
- Send letter to physical education department in schools suggesting programs on mouth hygiene.

October:
- Begin radio series
- Continue all talks to various lay groups
- Continue newspaper publicity
  - Use statements by heads of health organizations and agencies in series
- Reach house organs, club bulletins, suburban papers
- Send letters to dental clinics suggesting educational programs in clinics, such as display of posters, distribution of leaflets, short talks in waiting rooms, short talks to individuals

November:
- Continue talks to various lay groups
- Continue radio talks
- Continue newspaper publicity
- Continue plans for poster contest in public and parochial schools

December:
- Continue talks and put notices of talks in newspapers
- Continue radio talks
- Have plans for poster contest perfected and ready to launch at reopening of school.

January:
- Continue talks
- Continue radio talks
- Continue notices of talks in newspapers
- Continue newspaper publicity
- Launch poster contest
- See that plans for Mouth Hygiene Week are completed:
  - (*a*) Check dates for talks at noon-day clubs
  - (*b*) Check arrangements with drug stores for window displays
  - (*c*) Push preparation of programs in schools for the week

(*d*) Check dates for talks to pupils in high schools
(*e*) Arrange for showing films
(*f*) Arrange for radio talks

February:
Continue talks
Continue (2) radio series
Continue notices of talks in newspapers
Continue newspaper publicity
Begin judging of posters
Arrange for the display of posters
Arrange for picture and news item of pupils and their posters
Special publicity for any groups—Girl and Boy Scouts, etc., who have carried on programs

Feb. 28 to March 5, Mouth Hygiene Week:
Talks to luncheon clubs
Radio talks every day
Talks to pupils in high schools and examination of mouths
Window displays and demonstrations (drug stores, groceries and vacant store buildings)
Display of prize posters made by school children
Intensive publicity
Programs in schools
Bottle collars supplied by National Dairy Council distributed with milk on Monday, February 29.
Wagon posters displayed on milk wagons of three large dairy companies during the week
Letters to grocery and department stores and restaurant owners
(Burke Grocery added announcement over radio to their regular broadcast)

The financial plan for the campaign was as follows: The Cincinnati Dental Society contributed $200 and the Public Dental Service Society, $100; the Public Health Federation agreed to furnish clerical service and to meet a reasonable amount of expense for mimeographing, stamps, stationery, etc., and the remainder was underwritten by individual dentists. Our complete financial statement follows:

Receipts:

Cincinnati Dental Society..		$100.00
Public Dental Service Society		200.00
Contributions from individual dentists		394.21
Total.....		$694.21

Disbursements:

Slides $166.70		
Printing and signs.....	68.55	
Letters and postage.....	20.54	
Photographs	28.00	
Prizes: banner, cup and posters	74.25	
Carpenter's work	15.00	
Travel (Dr. Hyatt)	13.95	
Commercial artist	50.00	
Window cleaning and laundry	21.95	
Executive secretary (salary and expense)	184.18	
Miscellaneous.....	51.09	$694.21

The Public Dental Service Society contributed postage, stationery, etc., in the amount of $25.00; the Public Health Federation contributed postage, etc., in the amount of $80.00; total $105.00; total cost of campaign $799.21.

Late in January, as it became apparent that the work of arranging for window displays and other activities of the intensive campaign week was going to involve more work than committee members would be able to do, the services of a man formerly in safety work and with considerable experience in organization was secured, he being made executive secretary. Special committees were appointed to work on the final projects and the execution of these projects was put into the hands of the executive secretary.

SPEAKERS' BUREAU

(Dr. E. H. Jones, Chairman)

The first step taken by the Speakers' Bureau was to ask for volunteers among the dentists for speaking engagements. A committee of six dentists went over the roster of the Cincinnati Dental Society and selected all of those members who in their opinion would be capable of speaking to mothers' clubs and willing to do so. This group numbered 150.

Each dentist on this list was contacted by one of the six men on this committee, with the result that seventy-five dentists expressed their willingness to speak to mothers' clubs and civic groups.

The committee addressed a letter to all mothers' clubs and parent-teacher associations in public and parochial schools in the city and to all civic and service groups, asking the privilege of addressing them on the subject of mouth hygiene on some definite date. This was followed by a telephone call, at which time the date was set. All of these arrangements with mothers' clubs were made by telephone through the office of the Public Dental Service Society in the board of education. More than 500 calls were made in this part of the campaign alone.

During the summer, dentists who had volunteered to talk met four times to hold speaking clinics. Talks were given which were criticized from the floor. At one clinic, two-minute talks were given on various phases of dental care, such as prenatal, preschool, the first permanent molar, the care of the teeth from 6 to 15 years, and adults and the general care of the teeth. During these clinics and at meetings of the committee, there was a general agreement as to the content of the talks so that the information given in all talks would tend to be uniform. In the letter to dentists notifying them of the date of their talk, a list of slides was enclosed with their description. A list of topics was also enclosed, giving the particular subjects that all talks should stress and various other ideas which might be incorporated. This information served as a basis for the speakers in preparing their talks. Except for a few special assignments, talks were personally prepared by each speaker.

Slides were obtained from the Public Dental Service Society and the American Dental Association and from private collections. Some new slides were made. After the set of slides was compiled to the satisfaction of all, it was made up into four lots, so that there would be a sufficient number on hand to meet the demand for the great number of talks to be given. Other material such as toothbrushes, models and dental floss, to be used in demonstrations, were also acquired for use by the speakers. All of these were reviewed by the committee and those best suited to the purpose were chosen and arranged. Each mothers' club was called sometime before the date of the lecture to find out whether the school had a lantern. If it did not, the lantern was sent to the school, and the program committee was advised how to prepare the room for showing slides. A suggestion was made by a member of the committee that a group of volunteers might be secured who would make it their business to go to the mothers' club the day of the lecture and see that all arrangements were made; but this plan was not completed. About 100 mothers' clubs were addressed, about 5,000 persons being reached in this way.

Talks to luncheon and civic groups were left until the intensive campaign week or as near the time as the group could arrange. About nine of these types of organizations were reached, including High Y, Civic, Civitan, Knights of Columbus, Lions, Mercator, Optimists, Cincinnatus and Electric Clubs.

In addition to the talks by the dentists mentioned above, a letter was addressed to the members of the Community Chest Speakers' Bureau, especially those speaking on health subjects. This letter notified them that a mouth hygiene campaign was to be carried on from September to March, and asked them to stress the im-

portance of mouth health in their talks on whatever the subject might be. In order that the information might be authentic and uniform, a brief statement of the essentials of mouth health was included with the letter.

The following correspondence and material was employed in connection with the Speakers' Bureau:

1. Letter to presidents of mothers' clubs and parent-teacher associations asking for the name of the chairman of the program committee for the next year (card enclosed for reply).

2. Letter to mothers' clubs confirming arrangements for speaker made by telephone, stating name of speaker, day and hour.

3. Letter to president or secretary of civic clubs asking for name of the person to be seen regarding the speaker (card enclosed for reply).

4. Letters to clubs confirming date and hour and giving name of speaker.

5. Letter to dentist thanking him for accepting assignment, giving name and address of mothers' club and date and hour of talk.

6. List of slides, with description.

7. List of items to be incorporated in talk.

8. Letters to volunteers announcing the four speakers' clinics.

9. Questionnaire to be used by volunteers in criticizing talks given at speakers' clinics.

10. Letter to speakers listed under "health" in the Community Chest Speakers' Bureau, asking them to emphasize mouth hygiene and enclosing brief statement of essentials of mouth hygiene.

The following is suggested as an outline to be used in talks to mothers' clubs. Each speaker received one of these outlines as an aid to preparation of his talk.

POINTS TO BE STRESSED IN TALKS TO MOTHERS' CLUBS

Diet and care during prenatal period
Care of infant's mouth
Importance of temporary teeth
Importance of brushing from time of appearance of first tooth
Importance of first permanent molars
Regular and frequent dental attention
  (*a*) Care of small defects is less painful and less expensive
  (*b*) Extraction is prevented by stopping decay before tooth has been destroyed
Focal infection from teeth
Results of presence of bad teeth:
  (*a*) Decaying food harbored
  (*b*) Food contaminated during chewing
  (*c*) Digestion impaired
  (*d*) Inflammation of gums caused
  (*e*) Toothache
  (*f*) Focal infection and ill health
  (*g*) Crookedness of teeth
Teaching personal care of the mouth
  (*a*) Brushing
  (*b*) Use of dental floss

IDEAS WHICH CAN BE INCORPORATED INTO TALKS TO MOTHERS' CLUBS

1. Prenatal care is important.
2. The diet of the mother affects the structure of teeth.
3. The temporary teeth start to form during the third month of prenatal life and are almost completed before birth.
4. The infant's mouth should be kept clean by the use of clean cloth.
5. Breast feeding develops the facial muscles.
6. Breast feeding, when normal, provides the best food.
7. The temporary set of teeth are important.
8. Proper chewing of rough foods keeps teeth clean.
9. Proper chewing of rough foods massages and stimulates the gums.
10. The temporary teeth should be cared for from the time the first tooth makes its appearance.
11. The teeth must be kept clean for sanitary reasons.
12. The teeth must be kept clean to stop decay (explain how decay progresses).
13. The filling of small holes is important as it (a) prevents further decay; (b) causes less pain; (c) is less expensive, (d) prevents need for extraction from nerve or pulp involvement, and (e) prevents formation of abscesses which may infect the body.

14. Regular attention is necessary to prevent the serious breaking down of teeth.
15. It is impossible for a patient to know when a visit to the dentist is necessary because symptoms of trouble often are observed too late and tooth has decayed so badly that nothing can be done to remedy the trouble.
16. A regular time should be set for examination and this time adhered to. Your dentist can decide how often this is necessary, this depending on the condition of your mouth.
17. Many first permanent molars are lost because they are not noticed or are thought to be temporary (explain what and where the first permanent molar is).
    (*a*) The neglect of temporary teeth results in neglect of the first permanent molar.
    (*b*) Sixty-two out of every hundred children between the ages of 14 and 18 who have been examined have lost one or more of the first permanent molars.
18. The accumulation of tartar under the gums causes inflammation, bleeding and infection. Regular removal by a dentist will keep gums in a healthy condition.
19. Malocclusion is dangerous because teeth decay more easily and gums become inflamed more readily. Explain causes of malocclusion: thumbsucking; use of pacifiers; presence of disease (adenoids and mouth breathing); loss of teeth, showing how loss of "first" permanent molar causes tipping of teeth and loss of contacts, etc.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Surgery and Safety: Craftsmanship is of little worth, knowledge is of little worth, unless they are allied with surgical judgment. Now surgical judgment is partly based upon intuition, but it goes far beyond it. It is surely based upon knowledge. And it is chiefly based upon experience, which is the interpretation of what others have seen and done and thought and we have been wise enough to profit by. If, as some cynic has said, experience is the name we give our mistakes, it is likewise, if we are receptive, the touchstone by which we interpret life, and sure it is the foundation stone of judgment. Finally, no surgery can be safe unless the surgeon who performs it adds to his other qualities of mind and heart the greatest of them all, the thing that we call the surgical conscience. One need not necessarily operate in order to possess it. It is possessed in fullest measure, I would say, by the men who would like to be surgeons but who are not because they are honest enough to admit to themselves their lack of fitness for the task. It is the quality which makes the surgeon unwilling to operate until he is sure in his own mind that his training is adequate and his skill is sufficient for him to dare to lay hands upon the human body. It is the quality that makes him more than willing, which makes him eager, to accept the guidance of the man who knows more than he does of special diseases and special procedures. It is the quality which makes him call for assistance promptly and freely when he sees himself drifting beyond his depths. It is the quality which stays his hand from unnecessary surgery, which drives his hand to the surgery of desperation, the surgery that sullies his record, as he knows it cannot fail to sully it, but that gives to dying men and women their only chance of salvation. It is the quality that makes him realize the high seriousness of his calling, that makes him earnest in his purposes, honest in his mental processes, steadfast in his endeavors, courageous in the tribulations that are the inevitable lot of the physician who has chosen to be a surgeon. Matters of technique are important, but they need not be emphasized to the surgeon who possesses the qualities I have just named, natural aptitude, knowledge, judgment and the surgical conscience, for if he possess them, he cannot fail to possess their fruits. Safe surgery is not a matter of chance any more than it is a matter of complex details. It is first and foremost a matter of sound principles, a matter of the application of sound principles, and the responsibility of their application is the responsibility of the individual surgeon. Let him see to it, then, that he is what he should be, that he does what he should do, for upon his shoulders rests the heavy task of making surgery safe.—C. Jeff Miller, in *Am. J. Surg.*, August, 1931.

Present-Day Theories of Cause of Dental Caries: Martha Koehne (*J. Am. Diet. Ass'n*, March, 1932) summarizes her findings as follows: "This review is presented in an effort to show the many types of problems involved in seeking the cause of what is probably the most widespread disease known. The solution of the problem will require the united efforts of trained biochemists, nutritionists, bacteriologists, physicians and dentists. It is sincerely hoped that it will help to show the futility of researches in only one or two of these related fields, ignoring the others. The following appear to be the weak spots in the present-day theories: 1. Lack of a dependable quantitative method for estimating the concentration of acid-forming bacteria in mouths. 2. Lack of convincing evidence of significant differences in the chemical composition of blood and saliva, or in the mineral balance of those free from caries as compared with those very susceptible to the disease. 3. Lack of incontrovertible data—bacteriological, chemical or nutritional—as to what determines resistance or immunity to caries. 4. Lack of agreement as to what, if any, constituent or constituents of the diet favor the development of caries or prevent its development. 5. Lack of a satisfactory explanation as to how bacteria are held in place, with their acid protected

from contact with the highly buffered saliva. What is the constant source of food for the production of so much acid?" Under "Facts that must be explained before the problem of the etiology of dental caries is satisfactorily solved," the author lists: "1. Some apparently structurally sound teeth decay rapidly, while some very poorly formed teeth with very imperfect occlusion remain free from decay. 2. Incisors and the buccal surfaces in general are much less susceptible to caries than are occlusal pits, proximal surfaces and cervical areas. If caries is primarily of metabolic origin, why are not all teeth and all tooth surfaces equally susceptible? 3. Some persons on apparently satisfactory diets, and seemingly well-nourished, have many cavities, while others with poor food habits and showing evidences of malnutrition have few or none. 4. Teeth of children living in certain orphanages have a relatively low degree of caries, while eighty or ninety-five per cent of public school children living in their own homes exhibit a high degree of susceptibility to the disease. 5. No one has ever been able to produce caries experimentally in dogs, even though poorly formed teeth can be produced in them at will. Caries has been found occasionally in nonexperimental dogs but only in the cervical areas. Can this relative immunity to caries be explained on the basis of the conical shape of dog teeth and their natural self-cleansing arrangement which prevents adherence of food and micro-organisms? Certainly the metabolic theory does not satisfy us."

Replantation and Result After Twelve Years: The fact the we have few accurate accounts of the final results in cases of replantation led J. Lewin Payne (*D. Surgeon,* Aug. 1, 1931) to report the following case in which the teeth have remained in situ for many years: A young woman came to Guy's Hospital with a fibroid epulis in front of the lower incisors. On being told that the growth should be removed and the central incisors adjoining it extracted, the patient asked if it would not be possible to retain the teeth. An effort at replantation was promised after some hesitation on the part of the operator. An impression was taken, and a metal cap splint constructed to fit over the lower incisor and cuspid teeth. Nitrous oxid was then administered and both central incisors were extracted. Then the growth was excised and the alveolus to which it had been attached was curetted. The teeth were immediately placed in a warm saline solution and the operator, holding them in a sterile towel, opened the pulp chambers. After the pulps were removed, the canals were filled with an "osteo" filling of creamy consistency incorporated with nonabsorbent cotton. The teeth were then replaced in their sockets and the metal cap splint was fixed. When the latter was removed four weeks later, the teeth were found to be quite firm and the surrounding gum was quite healthy. Twelve years later, the teeth were removed when the roentgenogram showed rarefaction of the roots, which had been evident for three years. The patient had felt no discomfort. The author concludes: "The type of rarefaction found associated with teeth so treated has been described by some writers as similar to the physiological rarefaction in connection with roots of the deciduous teeth, but there is this essential difference—that in deciduous teeth the absorption leaves a comparatively smooth excavation on the surface of the root, whereas teeth which have been replanted, or transplanted, become roughened by deep excavations and present a honeycombed appearance. Doubtless the question will be raised as to whether such operations are justified in these days. As far as the transplantation of teeth from other people's mouths, or the implantation into artificially formed sockets, I have no hesitation in saying the answer should be in the negative. But, with regard to replantation, I think that in young, healthy patients, when an incisor or canine has been knocked out and can be replaced without delay, and under clean conditions, the operation is justified, and in a considerable proportion of such cases will give a comparatively successful result. Even in the most favorable cases, however, after a few years, one will, in all probability, find rarefaction of the root such as I have shown in this case."

Focal Infection: In his neglect to eliminate focal infection in the expectant mother, the obstetrician, Galloway (*Am. J. Surg.,* December, 1931) believes, is overlooking a definitely proved factor in miscarriage, pyelitis, mastitis, phlebitis, anemia and the toxemias of pregnancy. He cites cases of abortion and still-birth in which streptococci from the mother's urine, the placental and fetal heart blood or from foci of infection were isolated and injected into guinea-pigs, abortion resulting in the animals, with recovery of streptococci from the uteri. He cites Talbot's cases in which focal infection caused mastitis, pyelitis and miscarriage, and that author's belief that probably certain fetal deformities and

hemorrhagic disease of the newborn are due to chronic infection in the mother. Certain writers have made the statement that *Bacillus coli* infection is present in practically every case of toxemia of pregnancy, focal infection giving the organisms a chance for invasion through a lowering of the resistance. Danforth and Corbus are quoted as saying that as pyelitis is secondary in a large group of cases to foci of infection in teeth, tonsils and sinuses, these regions must be cleared of infection as the first step in its management. Other writers agree with this statement, advocating the removal of all foci of infection as a preventive measure in pyelitis of pregnancy. The author has demonstrated an increase in hemoglobin and red cells following the removal of certain foci of infection in pregnancy and in anemia persisting after delivery. He says: "These focal infections are found most commonly in teeth, tonsils, sinuses and the kidney. Of course, the most common location is the teeth or tonsils and especially the teeth, for an area of infection at the base of a tooth can drain only into the circulation. It may produce no symptoms whatever, but it is constantly exposed to pressure by mastication." The author insists on early full-mouth roentgen-ray examination for all expectant mothers coming under his care. The films are referred to the family dentist, and if roentgenologist, physician and dentist agree that an apical abscess exists, the patient is advised to have the tooth removed. This condition has been found in about 15 per cent of patients. The author believes that harboring a chronic focus of infection is probably a greater risk than its removal, and in fact has had no miscarriage from dissemination of infection result in either extraction or tonsillectomy cases. He concludes: "It is very hard to demonstrate any benefit from a preventive procedure such as the removal of various foci of infection, but since adopting the measure as a routine, I have had fewer cases of pyelitis, mastitis and toxemia."

Merits of General and Local Anesthesia for Oral Surgery and Exodontia: With the development of block anesthesia and the open view operation for the removal of teeth, the use of nitrous oxid-oxygen has decreased for all but the short or minor operations, according to Harms (*Cur. Res. Anes. & Anal.,* January-February, 1932). The chief users of nitrous oxid-oxygen, because of the refinements in technic which had come to be demanded, are obliged to employ one of three ways to maintain their practices: (1) to use nitrous oxid-oxygen only and continue to eliminate the more refined types of surgery, alveolectomy, cystectomy, removal of deeply impacted teeth and open view operations to a large extent; (2) to use both types of anesthesia; (3) to perfect their technic, train better surgical teams and continue to use nitrous oxid-oxygen for all operations. A few of the older operators are continuing the use of nitrous oxid as of old, using block anesthesia occasionally; the younger exodontists have changed over to block almost entirely or use nitrous oxid in rare instances; a third and smaller group have equipped themselves with a better knowledge of anesthesia, have perfected their surgical technic and use nitrous oxid for all the newer types of surgery. The author made his survey to determine the reasons for the choice of the exodontist as regards anesthesia practice. One hundred forty-three letters yielded forty-six replies. Few of the replies, the author states, were couched in the language of the anesthetist. Few seemed to consider the welfare of the patient, regarding first their own selfish interests. Seventy-six per cent mentioned the healing of tissues in the presence of certain disease conditions as better under general anesthesia; 52 per cent use a general anesthetic for children under 15; 60 per cent use a local anesthetic for long operations; these being the three outstanding points made in the replies received. Some believe that the patient or physician should be humored in his preference, and therefore the dentist should be well grounded in the use of both types of anesthesia. There is a wide variance of opinion as to which requires the most skill, etc., and as to the importance of cooperation of the patient. In some cases, economy enters large into the picture, as well as the matter as to whether the type of anesthetic used can have a bearing on practice building. Some suggest local anesthesia for men and general for women. The author concludes: "There seems to be no question that the subject of anesthesia in the dental and medical college is one of the unessential subjects, with the result that the students and interns of today look upon the administration of anesthesia with what might be termed a mild curiosity which seldom develops into a whole-hearted interest. In such a brief course of instruction as offered by the dental college in general anesthesia, it is, of course, unrea-

sonable to expect the dental student to become very proficient in the use of any anesthesia. Is the system that produces him (dentist or physician) the best system?"

Ocular Complications of Dental Sepsis: The first case quoted by Kiep (*Brit. D. J.*, Sept. 1, 1931) is illustrative of his belief that a discriminating attitude of mind must be maintained in cases of suspected dental foci in ocular conditions, the teeth in this case having been removed without amelioration of the corneal dystrophy, which improved only after removal of the tonsils. Of the cases in which the teeth were the unquestioned source of the pathologic process, he quotes that of a child under 2 years who had a right-sided orbital cellulitis, with no history of trauma or abscess. Examination revealed a septic inflammation of the first right upper molar, which showed extensive decay, with pus exuding from between root and gum. Extraction resulted in rapid improvement. In a second case, a young man, caught in a storm and thoroughly chilled, awoke later suffering intense pain in the left upper jaw and around the left eye, attended a little later by swelling and edema. Cellulitis of the left orbit was diagnosed, and it was learned that the patient had several bad teeth. The ophthalmoscope revealed dilatation of the retinal veins and a commencing optic neuritis. When it was found that the pulp cavity of the first left upper molar contained pus, the tooth was extracted, the bone between it and the antrum being found necrotic. Improvement of the patient's condition was "dramatic." The author answers the question as to what paths the infection followed by the suggestion that the alveolar venous branch of the pterygoid plexus which communicates with the ophthalmic (orbital) veins, or the lymphatics, which accompany some of these veins through the sphenomaxillary fissure into the orbit, may have offered an avenue for spread of the infection to the eye. The author abandoned the theory that optic neuritis occurred in the same way after two cases improved after extraction of an affected tooth on the opposite side. These cases and others in which the offending teeth were found in the lower jaw led him to consider favorably the theory that streptococci were carried through the blood stream from a dental focus to the ocular region. In conditions in which the connection with dental foci of infection is not so clear, such as iritis and iridocyclitis, the author has used with good, not to say striking results, vaccines developed by Henderson and Clarke after the latter succeeded in isolating various strains of streptococci from carious teeth and classifying them on the basis of whether they were agglutinated by the blood serum of the patient suffering from one or other of the specific strains of coccus. The author believes that debilitating diseases so lower the barriers of the intestines against infecting organisms that the latter are often able to escape into the blood stream and settle in the synovial membranes of joints or the iris or ciliary body of the eye. The influenza germ may escape in the same way from the respiratory tract and the streptococci from carious teeth. The statement that the majority of vitreous opacities of inflammatory origin and senile or presenile cataract are due to oral sepsis is difficult to disprove since some degree of sepsis is almost universal. The crux of the matter lies in the ability of the dentist to determine whether the sepsis is doing harm. The dental conditions that are liable to give rise to ocular complications are listed as pyorrhea, granuloma, septic stumps, residual fragments of teeth, impacted teeth, residual sepsis or bone infection and tartar. The ocular complications are orbital cellulitis, iritis, or iridocyclitis, or choroiditis, and, less definitely, optic neuritis without cellulitis. Possible resultant conditions are intractable corneal ulceration, styes and episceleritis. Other eye or lid affections the author does not regard as related to dental sepsis.

MISCELLANY

BOOK REVIEWS

Gold Inlays by the Indirect System. By Henry W. Gillett, D.M.D., New York City, Professor of Dentistry, School of Dental and Oral Surgery, Columbia University, Fellow of the Dental Society of the State of New York; Active Fellow of the New York Academy of Dentistry, Formerly Instructor of Operative Dentistry, Harvard Dental School, Member of the Board of Dental Examiners, State of Rhode Island; and Albert John Irving, D.D.S., New York City, Formerly Assistant Professor of Crown and Bridgework, University of Michigan, School of Dentistry, Active Fellow, New York Academy of Dentistry. 596 pages; 539 illustrations; price, $8.00. Published by Dental Items of Interest Publishing Co., Inc., Brooklyn, N. Y.

This book might logically have had a more comprehensive title than the one given it by the authors. In addition to a consideration of the technic of inlays by the indirect method, there is a rather comprehensive study in the early part of the volume of other methods of filling teeth, particularly in its historical aspect.

There is also a consideration of porcelain inlays, and altogether a rather broad approach to the entire question of filling cavities in teeth. All of this is interesting, and it will add to the value of the book.

In Chapter VIII, page 138, there begins the consideration of "Cavity Preparation by Classes for Gold Inlays by the Indirect Method" and this is followed by "The Technics of Cavity Preparation" and "Special Cases," constituting very appropriately a large section of the book—about 147 pages. When we consider that the basis of success in inlay work is cavity preparation, this emphasis on the subject must be considered logical and most appropriate.

From this forward, the treatment of the subject to the conclusion of the finished product is orderly and comprehensive, and there is no angle of the various topics that is not considered in some detail. The authors are so well known, and their imprint on dental literature has been so well established, that the reader may take for granted the fact that whatever they present on this subject will be pertinent and authoritative. The illustrations are numerous and most excellent, and in view of the fact that pictures mean so much in the technical presentation of inlay work, the authors and publisher have shown rare judgment in making this feature so prominent. The work as a whole reflects great credit on all concerned, and it is commended most highly as worthy of the confidence of the profession.

Dental Oral Surgery. By Wilton W. Cogswell, D.D.S., F.A.C.D., Oral Surgeon to Glockner Sanatorium and Hospital, Beth-El General Hospital, the National Methodist Sanatorium for Tuberculosis, St. Francis Hospital, Colorado Springs. 325 pages; 500 illustrations; published by the Dental Digest Publishing Company; price, $10.00.

The profusion with which books are coming out at present in dentistry should constitute an element of satisfaction to all of those who are interested in the growth of the profession.

Dr. Cogswell has written a book largely out of his own experience, and has illustrated it quite generously. This is in accordance with the most approved method of book publication in a subject like surgery, in which the technical procedures must receive the support of illustrative portrayal.

One of the most valuable chapters of the book is that on "Results of Mutilation and Tissue Loss on Dental Ridge Form." In the past, there has been needless mutilation and anything that will minimize it is commendable.

The mechanical makeup of the book and the quality of paper are in every respect in keeping with the general character of the volume, and must be highly commended.

Juvenile Dentistry. By Walter C. McBride, D.D.S., Detroit, Mich. 182 pages; 80 engravings. Published by Lea & Febiger, Philadelphia, 1932.

When we consider that 90 per cent of school children are in need of dental service of some kind, there is no question of the desirability

of presenting all of the good literature possible on this subject.

Dr. McBride has presented a treatise that will enable the average practitioner to approach the problem of caring for the teeth of children in a most acceptable manner. He has sketched the different topics in a brief and orderly fashion from a consideration of the management of children, through the various technical processes, down to the keeping of records. He has tried to bear in mind the child's point of view, and has adapted his methods to conform as nearly as possible with the requirements of the case in hand. The generally accepted opinion that children's dentistry is unprofitable has received refutation at the hands of the author, and his plan of management should be an object lesson for every operator.

Dr. McBride is well known for his interest in children's dentistry, and this volume will add materially to his reputation in this regard. A large sale is predicted for the book and a commensurate benefit to the profession.

Growth and Development of the Child, Part III, Nutrition. Report of the Committee on Growth and Development, Kenneth D. Blackfan, M.D., Chairman. White House Conference on Child Health and Protection. 532 pages; price, $4.00. Published by the Century Co., New York and London.

Nutrition Service in the Field. Report of the Subcommittee on Nutrition, Lucy H. Gillett, Chairman. White House Conference on Child Health and Protection. 139 pages; price, $2.00. The Century Co., New York and London.

Child Health Centers: A Survey. Report of the Subcommittee on Health Centers, J. H. Mason Knox, Jr., Chairman; Lillian Laser Strauss, Vice-Chairman. White House Conference on Child Health and Protection. 57 pages. Price of the two studies, $2.00. Published by the Century Co., New York and London.

The dedication of these volumes is most significant: "To the children of America whose faces are turned toward the light of a new day and who must be prepared to meet a great adventure."

Surely there is plenty of adventure for the children of the coming generation. To meet the need of the immediate days to come will require intelligence as well as energy, and it was for this purpose that the White House Conference was organized.

The various reports that have emanated from this conference are significant of the most advanced thought on the question, and such volumes as that on "Nutrition" and "Nutrition Service in the Field" will bear careful study. They deal with apparently every phase of nutrition and are as nearly authoritative as it is possible to make them with our present knowledge.

Every mother of a growing child as well as every teacher or nurse should study these reports and spread the knowledge contained therein to all who are in any way associated with children. Mayhap through such mediums as these, a better generation of children shall be reared.

Public Health Organization: Report of the Committee on Public Health Organization, E. L. Bishop, M.D., Chairman. White House Conference on Child Health and Protection. 345 pages; price, $3.00. Published by the Century Co., New York.

White House Conference, 1930. A Publication of White House Conference on Child Health and Protection. The key volume to all the reports of the White House Conference on Child Health and Protection, containing the leading speeches delivered at the Conference and abstracts of the Committees' reports with their recommendations. An invaluable source book and guide for all those whose chief concern is the welfare of children. 365 pages; board edition, $.50; cloth edition, $2.00.

SOCIAL INSURANCE: DETERIORATION OF QUALITY OF MEDICAL SERVICES UNDER COMPULSORY HEALTH INSURANCE

By EDWARD H. OCHSNER, M.D., Chicago, Ill.

In preceding articles, social insurance as a whole has been considered. In this and subsequent articles, our observations will deal more particularly with compulsory health insurance, one phase of social insurance. The chief danger to medical progress and to efficient medical service to the American public comes from that small group who wish to establish lay bureaucratic control over the private practitioners of medicine and dentistry.

The state exercises a legitimate and proper function in public hygiene and sanitation, the teaching of personal hygiene in schools and colleges and the medical care of paupers, criminals, and the indigent in general, but whenever and wherever it has entered into the private practice of medicine, it has always exhibited inefficiency. Even in institutional

work, with the possible exception of university clinics, the medical service rendered by the government is rarely excellent or even good, nearly always mediocre and oftentimes even worse.

The health, happiness, prosperity and efficiency of the citizenship of any nation depends more on the integrity, ability, unselfishness and enthusiasm of the medical and dental professions and on the quality of medical and dental service rendered to the people than on any other thing. Any change in the practice of medicine and dentistry which will in any way hinder these professions from giving their best services will eventually react unfavorably on the whole nation. That state medicine and compulsory health insurance actually will and does lower the general quality of medical and dental services is supported by reason and experience. While it may level up a little from the bottom, it unquestionably levels down from the top, and it is this leveling down that will surely stop medical progress.

Medical progress depends not so much on the rank and file of the profession as on occasional men with vision. If we unduly hamper these great medical minds, medical progress must cease. The quality of medical service received by the people in general depends in large measure on the quality of teaching which the rank and file of the profession receive and on the enthusiasm and the ideals which are instilled into them by their teachers. Men of great ability can do their best work only if absolutely free, and a physician under lay bureaucratic control never is entirely free. Andrew Carnegie, one of the most successful men of modern times in the best sense of that word, makes the following statement in his autobiography: "Thereafter I never worked for a salary. A man must necessarily occupy a narrow field who is at the beck and call of others."

One of the continually recurring misstatements in compulsory health insurance propaganda is that it encourages personal hygiene and, consequently, disease prevention. Nothing could be farther from the actual facts. Which person is more likely to take care of his teeth, the one who gets his dental services free or the one who has to pay for it out of his own pocket? Those who claim the former just do not know human nature.

One of the chief causes of wonder of the Germans during the World War was the splendid condition of the teeth of the American soldiers as against the almost universally poor teeth of the Germans. Why this great difference? The principal reason is that American citizens have their teeth taken care of by private dentists who take a personal interest in each patient. Most American dentists and physicians are spending much of their time instructing their patients in general and oral hygiene. Contrast this with the work of the *Krankenkasse* physician of Germany who asks his patient one or two questions, then reaches into a file, hands him a typewritten prescription and gets rid of him just as quickly as he can, and as he must, if he is to see fifty patients in an afternoon office period of two hours; and this he is of necessity compelled to do if he is to make a living for himself and his family at 12 cents an office consultation. Again, the claim is made that compulsory health insurance examinations are more thorough. This, too, is a statement contrary to fact and to reason, when one realizes that the sort of office consultation above described gives the physician the same pay as a thorough physical examination does. No man can afford to make a careful, painstaking examination for 12 cents; not even in Germany, where living expenses are almost as high as in this country. One *Krankenkasse* physician in Berlin told me personally that he made twenty-three house calls in four and one-half hours, or at an average rate of one in a little less than twelve minutes, driving from house to house, going up from one to four flights of stairs each time, examining a patient and prescribing for him.

Brend states that in England the average time spent by panel physicians in making a diagnosis is from three to four minutes. Another English writer, in commenting on the foregoing facts, rightly observes that these are not abuses of compulsory health insurance but inherent faults of the system.

We have all repeatedly seen and heard the statement that 70 per cent of the American people,—namely, the low and moderate income classes,—are not getting adequate and efficient medical services. Where those who make this statement get their statistics, no one has ever been able to find out. The fact is that there are no statistics available on this point. From this, it must be evident that the only place they can get these figures is from the depths of fertile imaginations.

If we stop to investigate the source of these

statements, we invariably find that they emanate from two classes of individuals. The first is a certain type of ultramedical specialist whose only experience is or has been with the extremely rich whom he charges exorbitant fees and with paupers whom he treats in charity hospitals. As a consequence, he has had no personal experience with patients with moderate incomes and has no right to express an opinion on this subject. The other class who repeat these figures are usually persons who never have had personal experience with the practice of medicine, and hence their opinions are practically worthless.

I maintain that the poorer classes of patients get better services in this country than they do in those countries of the world that have compulsory health insurance and that their medical requirements are at least as efficiently met as are their food, clothing and particularly housing requirements. This phase of the problem is an economic one and cannot be solved by a palliative such as social insurance is.

(The effect of compulsory health insurance on the quality of medical services will be further discussed in the next article.)

CORRESPONDENCE

Activities of the Committee On Educational Publicity

To the Editor:

No doubt matters have come to your notice concerning the agitation going on in the profession concerning the Educational Publicity Committee activities. I feel that there has been so much loose talk, so much misunderstanding and, in consequence, so many resolutions have been adopted which are not based upon the facts, that a statement should be made which will help to clarify the atmosphere.

You probably are aware that the so-called Little Rock type of publicity which was carried in the newspapers in display space had been in use for some time before it came to the attention of the Judicial Council. As Chairman of the Judicial Council, many inquiries concerning the ethics and propriety of using this type of publicity came to me. In view of the fact that this was an important and far reaching question, I, in response to such inquiries, advised that nothing should be undertaken until the question had been presented to the meeting in Memphis.

My report as Chairman of the Judicial Council, which was submitted to the Board of Trustees, called attention to the situation and suggested that the question be given careful consideration. To quote from that report: "So far as your Chairman can see, there is little to criticize in the copy itself. The question to be decided is rather the principle of this type of publicity." Again: "It is because of the growth of this idea that it will be necessary for the American Dental Association to take some action whereby it may exercise some control over its own members in this type of activity."

The Board of Trustees, after giving the question attention, approved of the principle of this type of publicity and subsequently the Educational Publicity Committee was appointed. My understanding is that this committee has the authority to pass upon the truthfulness, lack of exaggeration and absence of controversial material in such copy. The committee has not recommended, sponsored nor encouraged the use of this copy. Having passed upon it in respect to the matters referred to above, the committee leaves it for dental groups to use or not as they see fit.

The other responsibility placed on the Educational Publicity Committee is the dissemination of mouth health information through the public press and magazines, radio, lecture platform, etc. Such news items do not go into display space, nor are they paid for, except that publicity agents, Carl Byoir & Associates, have been employed to prepare such material for dissemination as outlined above. The committee has further been authorized to collect funds for this purpose. Carl Byoir & Associates are not preparing copy to be used and sold to dentists for use in display space, and neither are they interested in this phase of the publicity question. This in brief is what the Educational Publicity Committee has been doing.

Resolutions have been adopted by dental groups throughout the country and editorials have been written which are based upon the false premise that the Educational Publicity Committee is actively engaged in recommending and sponsoring advertising in display space. To date, in only one instance where dental groups have considered taking action upon this subject has the Educational Publicity Committee been communicated with for the purpose of ascertaining the facts.

There is in existence one set of resolutions

which have been circulated throughout the country which condemn a nonexistent situation and which have been adopted by numerous groups.

The simple facts as stated above cover all the activities of the Committee. Those contemplating organized action should give this important subject the careful consideration which it deserves.

Alfred Walker, *Chairman*
Committee on Educational Publicity

NEWS

Honourary Dean Webster Awarded Jarvie Medal: The Committee of the Dental Society of the State of New York has selected Dr. A. E. Webster, of Toronto, to receive the Jarvie Fellowship Medal, to be presented at the Annual Meeting of the Society in May, 1932. This is an outstanding honour, and one that is richly deserved. Dr. Webster has given unstintingly of his time and efforts to his chosen profession and has, on many occasions, made important contributions to dentistry. This honour is one that brings great credit to this country and Dr. Webster's many friends in Canada will be glad to learn of this recognition and offer their congratulations and good wishes that, for many years to come, Dr. Webster may be spared to continue his untiring and unselfish service.—*Oral Health*, June, 1931.

DEATHS

Cigrand, B. J., Batavia, Ill.; Northwestern University Dental School, 1898; died suddenly, May 16; aged 66.

Fogg, Walter Stanley: Lokeford, Calif.; Tufts Dental College, 1901; died April 29, aged 54.

Kepner, Walter H.: Bucyrus, Ohio; Chicago College of Dental Surgery, 1895; died, December, 1931.

Lynn, Harold J., Hubbard Woods, Ill.; Northwestern University Dental School, 1916; died, May 18, of pneumonia; aged 38. The widow and four children survive.

Matteossian, H. B., Philadelphia, Pa.; School of Dentistry, University of Pennsylvania, 1894; died, April 4; aged 59.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Buffalo, N.Y., September 12-16.

American Academy of Periodontology, Buffalo, N. Y., September 8-10.

American Full Denture Society, Buffalo, N. Y., September 9-10.

American Dental Society of Europe, Baden-Baden, Germany, August 9-11.

American Society of Oral Surgeons and Exodontists, Buffalo, N. Y., September 9-10.

Association of American Women Dentists, Buffalo, N. Y., September 12.

Fédération Dentaire Internationale, Zurich, Switzerland, August 2-9.

Greater New York December Meeting, New York City, December 5-9.

Interstate Dental Association, Bordentown, N. J., July 11-13.

Italian Stomatologic Congress, Rome, September.

National Association of Dental Examiners, Buffalo, N. Y., September 10.

Northern Ohio Dental Association, Cleveland, June 6-9.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Knoxville, Tenn., October 31-November 2.

American Dental Assistants Association, Buffalo, N. Y., September 12-15.

American Dental Hygienists' Association, Buffalo, N. Y., September 12-16.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

June

Arkansas, at Little Rock (6-8).
California (Southern), at Los Angeles (13-15).
Colorado, at Estes Park (20-22).
Georgia, at Atlanta (8-10).
Maine, at South Poland (16-18).
Mississippi, at Meridian (9-11).
Montana, at Bozeman (June 30-July 2).
Nevada, at Reno (4).
New Hampshire, at North Conway (1-3).
Wisconsin, at Milwaukee (7-9).
Wyoming, at Thermopolis (27-28).

July

New Jersey, at Bordentown (11-13).
Washington, at Seattle (5-9).

November

Florida, at Hollywood (3-5).

STATE BOARD OF DENTAL EXAMINERS

Alabama, at Birmingham, June 20. E. W. Patten, Secretary, Comer Bldg., Birmingham.

Arizona, at Flagstaff, July 25. Norton J. Wood, Secretary, Grunow Clinic, Phoenix.

Arkansas, at Little Rock, June 20-23. Clarence W. Koch, Secretary, Donaghey Bldg.

Connecticut, at Hartford, June 27-30. Almond J. Cutting, Recorder, Southington.

Colorado, at Denver, June 7-11. Zenas T. Roberts, Secretary, Metropolitan Bldg., Denver.

Delaware, at Wilmington, June 20-23. W. S. P. Combs, Secretary, Middletown.

Florida, at Jacksonville, June 22-25. R. P. Taylor, Secretary, St. James Bldg., Jacksonville.

Indiana, at Indianapolis, June 15. J. M. Hale, Secretary, Mt. Vernon.

Iowa, at Iowa City, May 30-June 2. Hardy F. Pool, Secretary, Mason City.

Kentucky, at Louisville, June 8-11. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

Louisiana, at New Orleans, June 15-18. Joseph L. Webre, Secretary, Audubon Bldg., New Orleans.

Maine, at Augusta, June 20-22. Alton H. Swett, Secretary, 192 State St., Portland.

Massachusetts, at Boston, June 14-17. W. Henry Grant, Secretary, State House, Boston.

Minnesota, at Minneapolis, June 10-16. W. H. Smith, Secretary, 2337 Central Park Ave., Minneapolis.

Missouri, at St. Louis, June 8-11. George E. Haigh, Secretary, Central Missouri Trust Bldg., Jefferson City.

Montana, at Helena, July 11-15. T. P. Regan, Secretary, Helena.

Nebraska, at Omaha and Lincoln, June 13-18. Mrs. Clark Perkins, Director, Lincoln.

New Jersey, at Trenton, June 27-July 2. John C. Forsyth, Secretary, 148 W. State St., Trenton.

New Mexico, at Albuquerque, June 14-18. J. J. Clarke, Secretary, Artesia.

Ohio, at Columbus, June 27. M. H. Jones, Secretary, 1553½ N. 4th St., Columbus.

Pennsylvania, at Pittsburgh and Philadelphia, June 16-20. W. A. McCready, Secretary, 1115 Highland Bldg., Pittsburgh.

Rhode Island, at Providence, June 28-30. Albert L. Midgley, Secretary, Union Trust Bldg., Providence.

South Carolina, at Columbia, June 20. David Aiken, Secretary, Winnsboro Bank Bldg., Winnsboro.

South Dakota, at Sioux Falls, June 27-29. John J. Berry, Secretary, Deadwood.

Tennessee, at Memphis, June 13. F. W. Meacham, Secretary, Hamilton Nat. Bank Bldg., Chattanooga.

Texas, at Houston, June 20-24. A. L. Nygard, Secretary, Medical Arts Bldg., Dallas.

Utah, at Salt Lake City, June 27-30. H. D. Brockbank, Secretary, Medical Arts Bldg., Salt Lake City.

Vermont, at Montpelier, June 27-29. H. B. Small, Secretary, Burlington.

Virginia, at Richmond, June 14. John H. Hughes, Secretary, Medical Arts Bldg., Richmond.

Wisconsin, at Milwaukee, June 13-18. S. F. Donovan, Secretary, Tomah.

AMERICAN FULL DENTURE SOCIETY

The American Full Denture Society will hold its fourth annual meeting, September 9-10, at the Hotel Buffalo, Buffalo, N. Y. A program of papers and clinics will be presented. J. G. McDowell, Nashville, Tenn., is chairman of the program committee. The annual president's banquet will be held Friday evening, September 9.

H. L. HARRIS, *Sec'y-Treas.*
Hamm Building
St. Paul, Minn.

MONTANA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Montana State Board of Dental Examiners will be held July 11-15, at Helena. For further information, address

T. P. REGAN, *Secretary*
Helena

ARIZONA BOARD OF DENTAL EXAMINERS

The next regular meeting of the Arizona Board of Dental Examiners will be held at Flagstaff, beginning July 25. Applications should be in the hands of the secretary fifteen days before date of board meeting. For further information and application blanks, address

NORTON J. WOOD, *Secretary*
The Grunow Clinic
Phoenix

CONNECTICUT DENTAL COMMISSION (CHANGE OF DATES)

The Connecticut State Board Examination dates have been changed from June 22-25 to June 27-30.

A. J. CUTTING, *Recorder*
Southington

FLORIDA DENTAL SOCIETY

The regular state meeting of the Florida Dental Society will be held at the Hollywood Beach Hotel, Hollywood, November 3-5.

C. E. BERKSHIRE
711 North A St.
Tampa

AMERICAN ACADEMY OF PERIODONTOLOGY

The nineteenth annual meeting of the American Academy of Periodontology will be held in Buffalo, N. Y., September 8-10 at the Lafayette Hotel.

C. H. GRACEY, *Secretary*
Fisher Building
Detroit, Mich.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the South Carolina Board of Dental Examiners will be held at the Medical Bldg., Columbia, the week beginning June 20.

DAVID AIKEN, *Secretary*
Winnsboro Bank Bldg.
Winnsboro

ITALIAN STOMATOLOGIC CONGRESS

The twentieth Italian Stomatologic Congress will be held this year at the time of the opening of the George Eastman Dental Institute, in Rome, to honor the founder and great philanthropist. Information regarding this occasion can be had by addressing

G. FIORDELMONDO, M.D., D.D.S.
65 Via Napoli
Rome, Italy

GREATER NEW YORK DECEMBER MEETING

The eighth annual Greater New York December Meeting will be held at the Hotel Pennsylvania, December 5-9. This meeting will be under the auspices of the First and Second District Dental societies of the State of New York, and will be dedicated to practical dentistry.

CARROLL B. WHITCOMB, *Chairman*

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The Lafayette Hotel will be headquarters for the eighth annual meeting of the American Dental Assistants Association, to be held in Buffalo, N. Y., September 12-15. For further information, address

RUTH M. CLARK, *General Secretary*
Suite 1-4, Scofield Bldg.,
Minot, N. D.

AMERICAN DENTAL ASSOCIATION

Buffalo, N. Y. Sept. 12-16, 1932.

HOTEL RESERVATION

In securing hotel reservations for the 1932 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

As your first choice may not be available, kindly indicate a second and a third choice. If none of these are available, the hotel manager will mail your application to the Chairman of Halls and Hotels Committee, who will make a reservation for you again in as favorable a hotel as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing it, in order that your room may be available for other members.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, BUFFALO, N. Y., SEPT. 12-16, 1932.

.....Hotel. .....1932.
Buffalo, N. Y.

Please reserve sleeping room accommodations as noted below:

.....Room (s) with bath for.....people. Rate desired $.....
(per day)

.....Room (s) without bath for.....people. Rate desired $.....
(per day)

Second choice hotel.....

Third choice hotel.....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
Applicant.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. J. G. Roberts, Chairman Halls and Hotels Committee, 1839 Hotel Statler, Buffalo, N. Y., who will attend to the assignment of this reservation.

HOTEL	With Bath One Person	With Bath Two Persons	Without Bath One Person	Without Bath Two Persons
ARLINGTON				
136 Exchange		$5.00		$3.00
BUFFALO				
Washington and Swan	$3.00 S*	4.50 S		
	3.50 T&S	5.00 T&S		
	4.00 T&S	6.00 T&S		
	4.50 T&S	6.50 T&S		
		6.50 TB		
CHELTENHAM				
234 Franklin		3.00-5.00 TB	$1.50	
FAIRFAX				
Delaware near North		5.00-8.00		
		Suites 10.00-12.00		
FORD				
Delaware near Chippewa	2.00 S	3.50 S-4.00 TB		
		4.50 S, 3 persons		
		6.00 S, 4 persons		
		7.50 S, 5 persons		
GRAYSTONE				
24 Johnson Park		3.00-5.00		
		6.00 TB		
LAFAYETTE				
Washington and Clinton	3.50	5.00-6.00		
	4.00	7.00 TB		
LENNOX				
140 North	3.50	5.00-6.00 TB	2.00	3.50-4.00
MARKEEN				
Main and Utica	3.00	5.00		3.00
	5.00	6.00 TB		4.00 TB
STATLER				
Niagara Square	3.50	5.50		
	4.00	6.00		
	4.50	6.50		
	5.00	7.00 TB		
	6.00	8.00 TB		
	7.00	9.00 TB-10.00 TB		
STUYVESANT				
245 Elmwood	3.00	4.00		
		Suites 5.00		
		Suites 6.50		
TOURAINE				
Delaware and Johnson Park	3.00	5.00		
	3.50	6.00 TB		
WESTBROOK				
Delaware at North		Suites 6.00		
		Suites 8.50		
		Suites 9.00		
MEN'S HOTEL (Men only)				
308 Pearl			1.00	

*S, shower, T&S, tub and shower; TB, twin beds.

RAILROAD RATES TO BUFFALO, N. Y.

The American Dental Association has discontinued the use of the Identification Convention Certificate, and again this year is using the "Certificate Plan." The certificates will be obtainable from your railroad agent, and NOT THROUGH THIS OFFICE. Following is full information regarding the plan.

The following directions are submitted for your guidance:

1. Be sure that when purchasing going ticket you request a CERTIFICATE. *Do not make the mistake of asking for a "Receipt."*

2. Present yourself at the railroad station for tickets and Certificates at least 30 minutes before departure of train on which you will begin your journey.

3. *Certificates are not kept at all stations.* If you inquire at your home station, you can ascertain whether Certificates and through tickets can be obtained to place of meeting. If not obtainable at your home station, the agent will inform you at what station they can be obtained. You can in such case purchase a local ticket to the station which has Certificates in stock, where you can purchase a through ticket and at the same time ask for and obtain a Certificate to place of meeting.

4. *Immediately on your arrival at the meeting present your Certificate* to the endorsing officer, Dr. John J. Ogden, Vice-President, as the reduced fares for the return journey will not apply unless you are properly identified as provided for by the Certificates.

5. *It has been arranged that the Special Agent of the Carriers will be in attendance on September 13 to 15 from 8:30 a. m. to 5:30 p. m., to validate Certificates.* If you arrive at the meeting later than September 15, after the Special Agent has left, you cannot have your Certificate validated and consequently you will not obtain the benefit of the reduction on the home journey.

6. Certificates issued to children at half fares will be counted the same as Certificates held by adults.

7. If your Certificate is duly validated, you will be entitled up to and including September 20 to a return ticket via the same route over which you made the going journey *at one-half of the regular one-way tariff fare* from the place of meeting to the point at which your Certificate was issued. *(The identical route must be used in both going and returning in order to benefit under the Certificate plan.)*

8. Return tickets issued at the reduced fares will not be good on any limited train on which such reduced fare transportation is not honored.

9. *No refund of fare will be made on account of failure to obtain proper Certificate when purchasing going tickets, nor on account of failure to present validated Certificate when purchasing return ticket.*

A program of exceptional merit has been arranged, and we extend to you a cordial invitation to be present.

Transportation Committee

O. J. SPECKER,
R. L. SPRAU,
HARRY W. NELSON,
E. J. JUSTIS,
H. B. PINNEY, *Chairman,*
212 East Superior Street, Chicago, Ill.

BOOKS PUBLISHED IN 1932

which may be borrowed* or purchased

from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

212 E. Superior St., Chicago, Ill.

Beck, Dorothy F.	Cost of equipping a dental office. Chicago, University of Chicago Press, 1932. $1.00.
Bosworth, H. J.	Dental economics. Chicago, Bosworth Economic Institute, 1932. $10.00.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest, 1932. $4.00.
Cogswell, W. W.	Dental oral surgery. Colorado Springs, Press of Out West Printing and Stationery Co., 1932. $10.00.
Felcher, F. R.	Art of porcelain in dentistry. St. Louis, Mosby, 1932. $9.00.
Ferguson, H. W.	Child's book of the teeth. Yonkers-on-Hudson, World Book Co., 1932. $.68.
Gillett, H. W., & Irving, A. J.	Gold inlays by the indirect system. Brooklyn, Dental Items of Interest, 1932. $8.00.
Graves, Lulu G.	Foods in health and disease. New York, Macmillan, 1932. $3.50.
Hodgen, J. D.	Practical dental metallurgy. St. Louis, Mosby, 1932. $3.75.
Leuck, Miriam S.	Study of dental clinics in the United States: 1930. Chicago, University of Chicago Press, 1932. $1.00.
Leven, Maurice, & Beck, Dorothy F.	Practice of dentistry and incomes of dentists in twenty states: 1929. Chicago, University of Chicago Press, 1932. $2.00.
Margolis, H. M.	Conquering arthritis. New York, Macmillan, 1932. $2.00.
McBride, W. C.	Juvenile dentistry. Philadelphia, Lea & Febiger, 1932. (Price unknown.)
Pusey, W. A.	Doctor of the 1870's and 1880's. Baltimore, C. C. Thomas, 1932. $3.00.
Report of Committee on Growth and Development	Growth and development of the child. Part III. Nutrition. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $2.00.
Report of Committee on Public Health Organization	Public health organization. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $2.00.

*Books may be borrowed by members of the Association for a period of one week after date of receipt; and if not reserved for someone else, the period will be extended on request. A deposit of $2.00 for each volume to be sent at one time should accompany all requests for books This will be refunded on return of books.

If you wish to purchase books, indicate plainly which books you desire and enclose check with order.

List of books published prior to 1932 will be sent on request.

Reports of Subcommittees on Nutrition and Health Centers	Nutrition service in the field. Child health centers: a survey. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $2.00.
Simons, A. M., & Sinai, Nathan	Way of health insurance. Chicago, University of Chicago Press, 1932. $2.00.
Webster, A. E.	Manual for dental assistants. Philadelphia, Lea & Febiger, 1932. $3.50.
William, Maurice	Sun Yat-Sen versus communism. New evidence establishing China's right to the support of democratic nations. Baltimore, Williams & Wilkins, 1932. $5.00.

Give Written Instructions to Your Denture Patients

A booklet entitled "Your New Teeth," may be procured for distribution to your patients from the Library Bureau of the American Dental Association. This booklet is intended primarily for the patient who is wearing dentures for the first time. It enumerates some of the difficulties that may be encountered when one first wears dentures and offers suggestions as to how these difficulties may be overcome. There is also much of interest to the patient who has been wearing dentures, as information is given regarding the care, repair and rebasing of dentures. The information in this booklet was taken from the article entitled "Instructions for the Edentulous Patient," by B. L. Hooper, which was published in The Journal, February, 1932. The price of these booklets is: 25, $1.00; 50, $1.50; 100, $2.00. Kindly send remittance with order. A sample of booklet will be sent on request.

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1931-1932

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THOUSANDS of dollars are spent each year by the Council on Dental Therapeutics and Bureau of Chemistry in the endeavor to give the dental profession, and indirectly the public, the benefit of intensive examination and analysis in the therapeutic field.

THOUSANDS of dollars are spent each year by the Research Fellowship at the Bureau of Standards in promoting research in the dental field for the immediate benefit of the dental profession and the ultimate benefit of the public.

THOUSANDS of dollars are being spent by the Bureau of Public Relations in carrying out a fundamental program in educating children and their parents through school and community health programs.

THOUSANDS of dollars in advertising revenue is foregone because claims for products or the products themselves are not acceptable.

WHY?

Just Because

MANY MORE THOUSANDS of dollars are **SAVED** to the dental profession and the public through these united efforts on the part of organized dentistry to present desirable products and reliable information.

MANY MORE THOUSANDS of dollars are **SECURED** by the reputable dental manufacturers and dealers whose products meet these high standards.

MANY MORE THOUSANDS of Friends will be **MADE** for the dental profession when the full benefit of this work is realized.

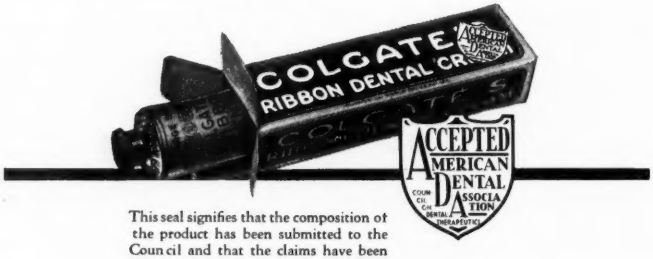
WHERE COLGATE'S steps into YOUR PRACTICE

THERE is only one place all along the line where Colgate's can become a part of your practice. When any patient asks you to recommend a good toothpaste . . . that *cleans* well . . . you can answer Colgate's.

Clean is the key to Colgate's story. Colgate's maintains today—as it always has—that the one function of a dentifrice is cleansing. No dentifrice can be a cure-all, nor take your place in any way whatsoever.

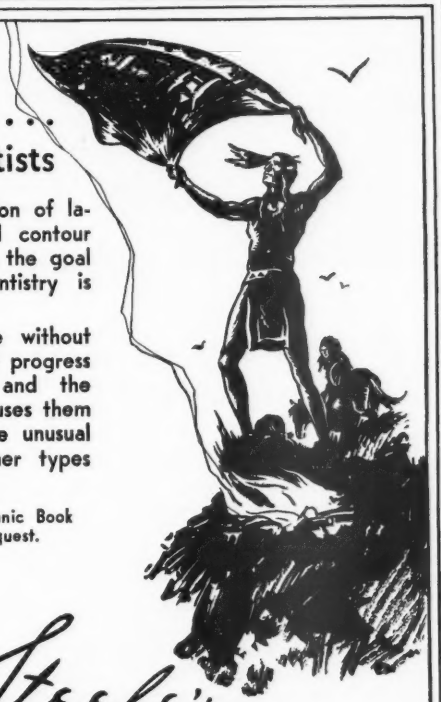
By virtue of this truthful claim of cleanliness; by playing as fairly as possible with the dental profession always, Colgate's not only won the friendship of thousands of dentists—but earned the right to the Seal of Acceptance. You see it on the package.

Thus it is that you can advise your patients to clean their teeth with Colgate's — knowing that where Colgate's steps into your practice it does so only in a way you yourself approve.



This seal signifies that the composition of the product has been submitted to the Council and that the claims have been found acceptable to the Council.

SIGNAL FIRES



A Message To • • • Far-Seeing Dentists

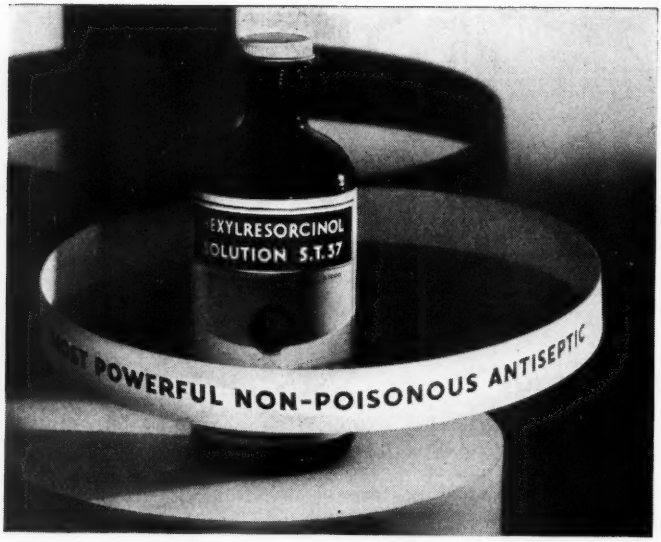
The exact reproduction of labial anatomy, lingual contour and natural shade is the goal which prosthetic dentistry is striving to attain.

Trupontic teeth are without doubt leaders in this progress towards perfection and the modern dentist who uses them can readily grasp the unusual advantages over other types of teeth.

A Free Complete Technic Book will be sent on request.

Steele's
INTERCHANGEABLE
Trupontics
PAT. PENDING

THE COLUMBUS DENTAL MFG. CO., Columbus, Ohio, U.S.A.



A powerful antiseptic in Oral Surgery

HEXYLRESORCINOL Solution S. T. 37 is a valuable aid in checking and preventing infection in the dental zone.

The active ingredient of Hexylresorcinol Solution S. T. 37 is Hexylresorcinol—70 times more powerful than phenol. This solution, with the low surface tension of 37 dynes, affords rapid penetration of microscopic crevices and folds of mucous membrane.

Although Hexylresorcinol Solution S. T. 37 is extremely powerful in bactericidal activity, it is non-poisonous and non-irritating. It is pleasant for your patients — and economical! For even when diluted three times it destroys pathogenic organisms on less than 15 seconds' contact.

Apply Hexylresorcinol Solution S. T. 37 in your office treatment. Recommend it for use at home between visits. It can be obtained at any drug store—in 3-ounce and 12-ounce bottles. Trial bottles will be sent on request.

HEXYLRESORCINOL SOLUTION S. T. 37

SHARP & DOHME • Philadelphia • Baltimore

BEWARE OF THESE GUNMEN!

HOW DO YOU KNOW THAT OXIDE AND SULPHIDE ARE NOT IN THE AMALGAM YOU ARE PUTTING IN YOUR PATIENT'S TEETH?

"OXIDE" and "Sulphide" are harmful impurities. They have no place in any alloy. They hinder amalgamation and remain in the mix as so much dirt. They result in faulty restorations and they discolor the tooth structure itself.

Be sure—absolutely sure—they are not in the alloy you are now using.

You can be sure if you use Twentieth Century Alloy (Caulk).

Twentieth Century Alloy is produced from the purest silver, tin, copper and zinc. It is melted, cast and annealed under conditions which should exclude contamination. Yet surface contamination cannot be excluded as we have learned from many experiments. Hence Caulk developed a scientific process for the chemical purification of alloy. This special Caulk process is patented, and is not, nor cannot, be employed by any other manufacturer. We know that it positively removes oxides, sulphides and other impurities that are picked up in the process of manufacture.

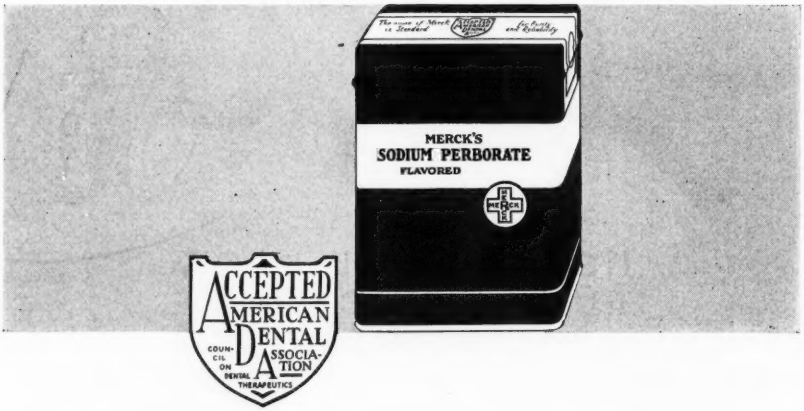
We know, and you know, that Twentieth Century is the purest obtainable alloy. Be safe. Be sure. Use Twentieth Century.

CAULK TWENTIETH CENTURY ALLOY

is made by a special patented process which eliminates every impurity in every step of its manufacture

MERCK'S

SODIUM PERBORATE FLAVORED



DENTISTS WRITE TO US TO SAY.....

"I have had good results from using the above antiseptic, particularly in Trench Mouth."

"I have yet to find a material with which a patient, using a brush, can keep the mouth and teeth in as cleanly a condition as with Sodium Perborate *Flavored*."

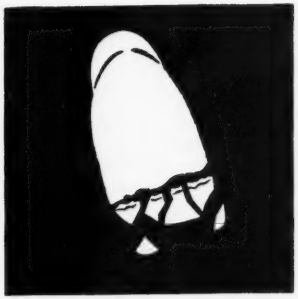
"Not only am I using it for Vincent's Stomatitis, but for other forms of periodontal lesions."

"For cleaning artificial teeth (plates) it has no competition."

The foregoing quotations are extracts from letters of some of the dentists who have voluntarily written us about Merck's Sodium Perborate *Flavored*.

Merck & Co. Inc., Manufacturing Chemists, Rahway, N. J.

AN INCREASING NUMBER OF TOOTH BREAKAGES?



NUFORM'S METHOD OF RETENTION

By embedding seamless anchorages in the plastic porcelain at the point of greatest bulk, we have created a soldered-in-pin condition where it is actually impossible to pull out the pin without purposely crushing the tooth. This is admittedly the most practical and satisfactory method of retention yet devised.

THERE may be, but the epidemic certainly hasn't reached the vicinity of Nuform Teeth . . . and we can safely say *never will.*

That there is *less breakage* with Nuform Teeth is a definite, conclusively-proved fact. Every dentist and laboratory man who has ever compared them, *knows* that. And you, if you've never used them, can satisfy yourself in five minutes by simply making tests.

The secret of Nuform's freedom from abnormal breakage is a two-fold story . . . has to do with superior porcelain and an improved method of retention.

The Universal porcelain used in Nuform Teeth is amazingly fine. For grinding and polishing qualities, density, translucency and lifelikeness, there is literally nothing on the market to compare with it (a statement readily substantiated by the facts).

And Nuform's method of retention, described separately on this page, is of equal superiority. The result is not only less breakage but greater all around satisfaction for both doctor and patient.

You can convince yourself of these facts and enjoy a saving at the same time, by ordering the special Nuform $25. assortment. $28.60 worth of teeth (11 sets) and a $10. Nuform Mold Guide—a saving of $13.60.

UNIVERSAL DENTAL COMPANY

Makers of Nuform Teeth

48TH AND BROWN STREETS, PHILADELPHIA, PA.

ITE-CO

THE ORIGINAL DENTURE CONDENSATE

A Distinct Achievement in Prosthetic Science . . .

Eight years of painstaking scientific research in condensates have produced in Ite-co the most nearly ideal denture base to be had today, for these reasons:

Ite-co possesses unusual beauty and natural mouth tissue color . . . Withstands the stress of the hardest "biters" . . . Provides complete mouth comfort. Has a "caressing" fit as it never warps nor distorts . . . Has a high degree of thermal conductivity . . . Resists absorption of mouth secretions because of its dense, porcelain-like texture . . . Has no more odor or taste than porcelain . . . Specify Ite-co for your next full or partial case.

ITE-CO TECHNIQUE IS SIMPLE, EASY

Ite-co denture base material manipulates easily and Ite-co technique is simple. A complete, detailed technique chart accompanies every package of Ite-co. All laboratories make Ite-co dentures and dental supply houses carry Ite-co. Ask for it for your next full or partial denture case.

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ITE-CO

PLEASE SEND FOR BOOKLET

THE ITE-CO COMPANY
22nd and East Hoyt Streets, Portland, Oregon, Dept. JAD-5
Send me your new booklet **"Progress of Denture Bases"**

Name.....

Address.....

Dental Supply House.....

Decay can be prevented if bacterial acids are neutralized

WHILE much evidence has been produced to prove that deficiencies of the diet are accessory causes of dental caries, one fact remains—*tooth decay begins on the surface of the tooth*. Decay is directly caused by food particles which lodge in protected places on the enamel surfaces where bacterial acids are formed.

Because bacterial colonization most frequently occurs in places not readily reached by a tooth-brush, bacterial acids must be neutralized. An antacid dentifrice accomplishes this function most effectively.

Squibb Dental Cream, the antacid dentifrice, is made with Milk of Magnesia, a product which has higher antacid properties than other neutralizing agents used in cleaning the teeth, and yet it yields very little soluble alkali. When Milk of Magnesia penetrates into the crevices of the teeth it effectively combats the concentration of bacterial acids which cause decay.

Squibb Dental Cream is made by a scientifically balanced formula. It cleans teeth thoroughly and *safely* because it contains no grit, no irritant—nothing which can possibly injure tooth enamel or gum edges.

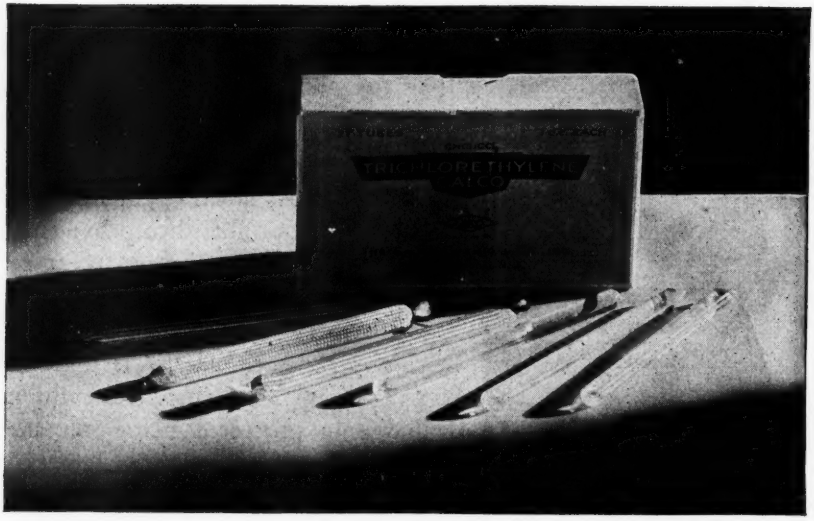
For a complimentary package of Squibb Dental Cream mail your Professional card to the Dental Department, E. R. Squibb & Sons, 745 Fifth Avenue, New York

SQUIBB DENTAL CREAM

A MODERN DENTIFRICE FOR MODERN DENTISTRY

TRICHLORETHYLENE-CALCO

($CHCL{:}CCL_2$)



The Conservative Treatment of Trigeminal Neuralgia

The Treatment of Election in Each Case of Tic Douloureux is Trichlorethylene-Calco.

A recent study of the literature has revealed a large percentage of cases relieved from pain by the administration of this drug in tic douloureux. A small percentage of cases remains permanently free from attack.

Where the drug is effective, the most severe cases are enabled to pursue their vocations without interruption; and in others the attacks are reduced both in number and severity. When these effects are obtained the difficulties and dangers of the radical treatment, by whatever technique or approach, are avoided. The drug may also be used preoperatively. Investigation reveals that large doses of Trichlorethylene produce narcosis, and that excessive doses may cause death. The drug must, therefore, be used with suitable control.

Bibliography

Glaser: J. A. M. A.: 96:916:(March 21, 1931) . . . Duffield-Fahy: Dental Cosmos, Sept., 1931 . . . Saphier: Munch. Med. Woch.: 67:133:(1920) . . . Bab: Klin. Woch.: 2:474(1923) . . . Blumenthal: Deutsch. Med. Woch.: 5:140:(1924) . . . Goldberg: Zeitsch. f. Nervenh: 32:(1924) . . . Lehmann: Arch. f. Hyg.: 74:1: (1911) . . . Plessner: Klin. Woch. 53:25:(Jan. 3, 1916) . . . Oljenick: J. A. M. A. p. 1088:(Oct. 13, 1928) . . . Joachimoglu: Klin. Woch.: 58:147: (1921) . . . Glaser: West. Jrnl. Surg. Obs. & Gyn.: 39:12:902:Dec. 1931.

Our laboratory, some time ago, developed the technique for making trichlorethylene suitable for medicinal purposes. The resultant product has been under constant observation since, to insure its continued stability under normal conditions.

Standard dosage of Trichlorethylene-Calco is 3 or 4 ampules in twenty-four hours. The ampule is easily crushed in a folded handkerchief and inhaled, in a reclining position, until all of the sweet, distinctive odor has disappeared. A fair trial period of the drug should be from a month to six weeks. In the case of even partial relief the patient should be encouraged to continue the treatment in the hope of averting other measures.

Trichlorethylene-Calco Is Dispensed in Boxes, Each Containing 21 Frangible Ampules. Available at Pharmacies or direct from this Company.

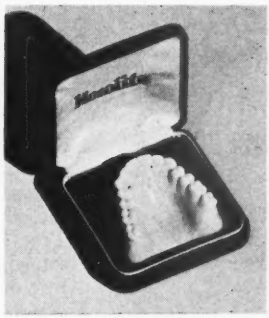
Pharmaceutical Division

THE CALCO CHEMICAL COMPANY, Inc.

Bound Brook, N. J.

A Unit of American Cyanamid Company

USE HECOLITE FOR CONSISTENTLY BETTER DENTURE RESULTS



From the day it was offered to the American dental profession more than seven years ago, Hecolite has always given uniformly excellent results.

Of the millions of Hecolite dentures that have been made, the percentage of failures, due to all causes, has been very small. They are almost negligible when compared to the vast numbers giving daily, uninterrupted satisfaction. Many dentists tell us they have more consistent success with Hecolite than with any material they have ever used.

You, too, can enjoy this full measure of success in your denture practice, if you use Hecolite. Its chemical resistance to acid or alkaline saliva, its chemical stability to withstand the attacks of ptyalin, the active enzyme in saliva, insures plates of lasting satisfaction. Hecolite does not become soft or soggy or pull away from the teeth. It retains its firm, dense texture indefinitely. Its physical stability and greater strength minimize warpage, shrinkage, and fractures.

This, then, explains why more than 2,000,000 Hecolite dentures are giving perfect satisfaction to denture wearing patients everywhere, and why more dentists are using Hecolite for consistently better denture service.

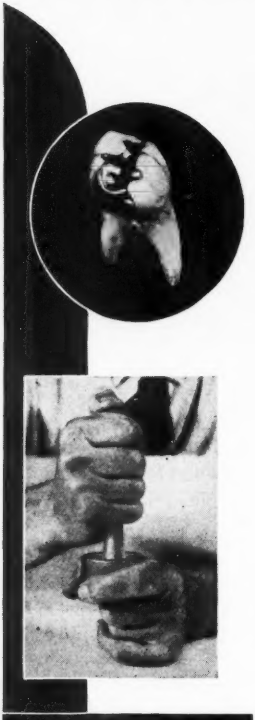
But to get these results, the results that only genuine Hecolite can give you, accept no substitutions. See that each blank bears the Hecolite trade-mark plainly stamped upon it. Insist that your laboratory deliver the finished denture in the original green container sealed with the black and gold Hecolite seal. American Hecolite Denture Corporation, 94 E. 6th Street, Portland, Oregon, or 41 Union Square W., New York City.

YOU DON'T EXPERIMENT WHEN YOU USE

HECOLITE

T.M. Reg. U.S. Pat. Off.

TRUE DENTALLOY WORKS WITH YOU ALWAYS IN MAKING FILLINGS THAT ENDURE « « « « «



In your aim toward the goal of master in creating beautiful and durable amalgam fillings, it is imperative that you use an alloy that will work with you, so that your skill moves unerringly to the desired end. There must be a certainty of action in the alloy upon which you can depend.

True Dentalloy is an alloy of this type. It is a balanced alloy, the first balanced alloy ever made. The physical properties of every lot of materials entering True Dentalloy are balanced one against the other with rigid care so that every bottle of True Dentalloy will meet the requirements of a set standard for uniformity. The reaction therefore of every lot of True Dentalloy is always the same; you soon perceive this, and you proceed through each step of your technique in comforting confidence, knowing that the expected will happen.

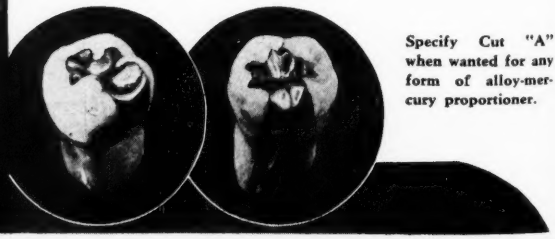
There is another feature of True Dentalloy which aids in securing that perfect adaptation—it expands slightly in the initial set to seal microscopic spaces and make a hermetic seal. True Dentalloy really does work with you.

TRUE DENTALLOY

is sold by Leading Dental Depots

20 ounce rate, per ounce	**$1.80**
10 ounce rate, per ounce	**1.90**
5 ounce rate, per ounce	**2.00**
1 ounce bottle	**2.15**

(One and Five Ounce Bottles)



Specify Cut "A" when wanted for any form of alloy-mercury proportioner.

S.S.White Filling Porcelain Has A New Cabinet

If you are a user of Filling Porcelain, you know the fascination this worthy material affords in working with it. You know the satisfaction it is giving patients, and the stimulating effect it has upon the growth of dental practice.

Perhaps too you have experienced all of the foregoing from the use of a few Filling Porcelain colors. If so, there will be no limit to the all around satisfaction that the twelve color Filling Porcelain Cabinet will give you. It will equip you to match every tooth color presented. It will keep the powders, liquids, and silicate accessories together, away from contamination, and ever ready and convenient to use.

The new cabinet is of mahogany finish, it is highly polished; measures 13¾"x7"x4"; is narrower than the old cabinet and will not extend over the edges of the equipment cabinet. Also it can be used for six or twelve colors.

Contents

12 bottles of Powder, colors 1 to 12
2 bottles of Liquid
1 bottle of Varnish and Cavity Lining
1 bottle of Solvent for Varnish
1 box Celluloid Strips No. 2
1 Agate Spatula
2 double-end Tarno Instruments
1 Mixing Tablet
1 tube Cocoa Butter
5 Pipettes

Complete with Blending Guide $45.00

Phone Your Dealer Today

FOR SHEER EFFICIENCY

Luer Slip (Security)

Luer Slip

Standard Thread (Security)

For sheer efficiency, no needle surpasses **B-D** Yale Needles of carbon steel, chromium finished. They have the keenest, smoothest points obtainable and stand alone in ease of insertion, assuring comparatively painless penetration. They are preferred except when unusual resistance to rust is required.

B-D Erusto Needles of Firth-Brearley Stainless Steel are indicated for any purpose requiring a rust-resisting needle. They are strong, flexible and keen, and are recommended as the standard stainless steel needle.

B-D Dental Needles are supplied in Luer slip, Standard thread, and Security types. The Security type has a metal bead near the hub. In case of accident, the needle generally breaks at the point where it joins the hub, leaving sufficient projection for quick and easy removal from the tissues.

Sold Through Dealers

B-D PRODUCTS

Made for the Profession

Makers of Luer-Lok and Sana-Lok* Syringes, Asepto* Syringes, B-D* Water Syringes, Dental Needles, Chip Blowers, Blood Pressure Instruments, and B-D* Thermometers.*

*Trade Marks of Becton, Dickinson & Co.

BECTON, DICKINSON & CO., Rutherford, N. J.

Gentlemen: ADA-6

Please send literature on B-D Dental Needles.

Name .....

Address .....

Dealer's Name.....

BECTON, DICKINSON & CO., RUTHERFORD, N. J.

Price Reduction
Same Quality

NEW PRICES ON KERR PERFECTION IMPRESSION COMPOUND. BUY IN QUANTITY LOTS AND INCREASE YOUR SAVING. KERR COMPOUND KEEPS.

Cakes, Sticks, Cones, Wafers or Pyramids:

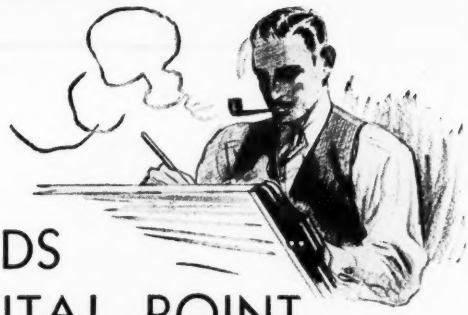
1 box - - - $0.50	6 boxes - - $2.75
12 boxes - - 5.15	20 boxes - - 8.35

KERR COMPOUND IS GUARANTEED TO MEET THE SPECIFICATIONS OF THE AMERICAN DENTAL ASSOCIATION.

DETROIT DENTAL MANUFACTURING CO.

For Sale by all Leading Dental Depots

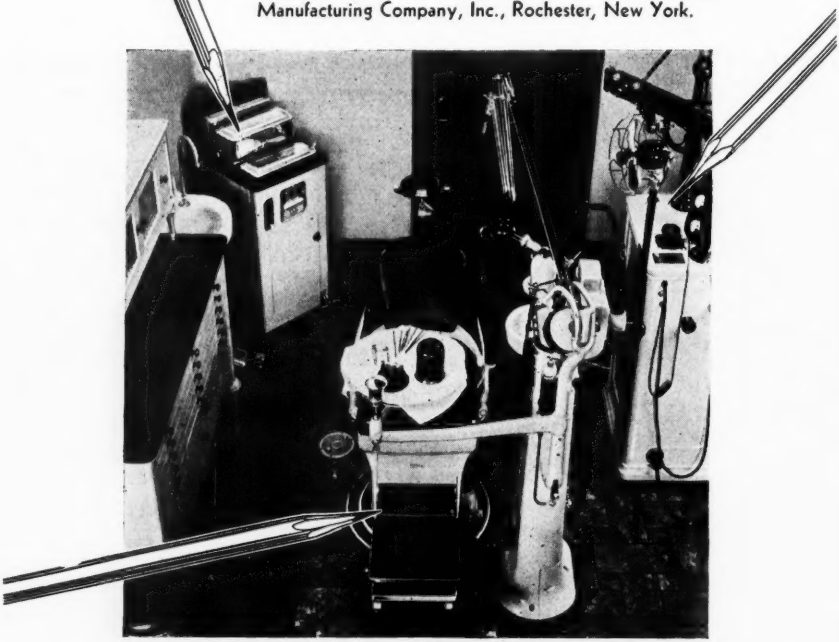
Designed to fit YOUR NEEDS at every VITAL POINT



YOUR operating technique, Doctor, is planned for greatest effectiveness with a minimum of effort. Why not have your office planned for operating convenience of equal efficiency?

The experience gained by Ritter and Ritter dealers in the planning of 18,000 dental offices is available to every dentist. Complete plans . . . of reception room, business office, operating room and laboratory will be prepared by our Architectural Department free, on request.

May we not plan or re-plan your office soon? Telephone your Ritter dealer or write direct to us. Ritter Dental Manufacturing Company, Inc., Rochester, New York.



RITTER

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Your Dental Scrap will buy more today than at any time since 1913!

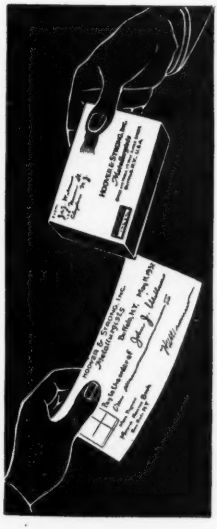
THE gold standard keeps the nominal value of gold constant. At the same time the price of commodities has been greatly reduced in recent years. This means that ***your*** Private Gold Mine of scraps is worth MORE... because they'll BUY MORE than at any time since 1913.

No matter what you have containing any precious metal (gold, silver, platinum) gather it together and ship it to Hoover. Hoover pays the highest prices for your scrap and the returns are prompt. After all, "It's the Amount of the Check that Counts."

Your values returned if you are not satisfied, or if you prefer, we will hold them until you approve our offer. It's a simple matter to ship your scraps in Hoover containers. They're furnished free. Write for yours.

WE REFINE: *Teeth or other material containing precious metal; Bridge Scrap; Amalgam Scrap; Grindings; Platinum Scrap; Gold and Silver Scraps; Bench and Floor Sweeps.*

Shipping containers furnished FREE on request.



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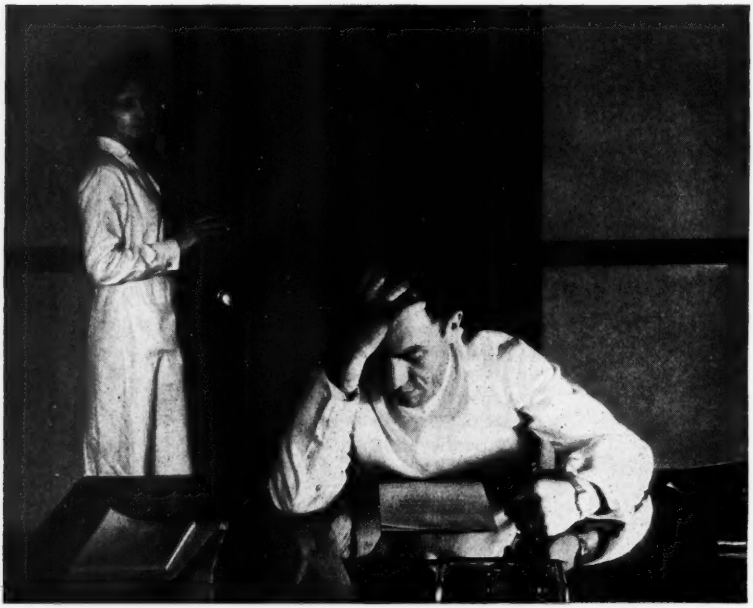
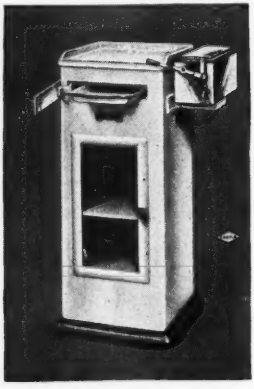
Golden Rule Refiners and Manufacturers Since 1912

You Wouldn't Forgive Yourself





No. C1413

if infection set in . . .

Neither your patient nor your profession will find excuses for infection . . . because all the world knows that it can be controlled. Give yourself . . . your patients . . . your reputation complete protection with a Castle Sterilizer. Have nothing to forgive or forget. Insist on the Castle «Full Automatic» which controls its own heat; gives automatic sterilization in addition to low water cut-off. No three heat switch to fuss with . . . to forget. And—only Castle boilers are cast in solid bronze that cannot crack, warp or buckle. Send for the Castle catalog.

Wilmot Castle Company
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CASTLE STERILIZERS

Carry Your Efficient Technic into the Processing Room

THE results of skilled exposure technic can be nullified in the processing room. Poor processing procedure may also lead to misinterpretation of the radiographic evidence.

Efficient processing procedure rests largely upon adequacy of equipment. The developing tank, film hangers, timer, thermometer, and safelight lamps must meet all requirements . . . the chemicals must be uniformly pure, to insure satisfactory results.

Eastman processing room equipment is scientifically designed to facilitate standardized procedure . . . Eastman Prepared Processing Powders are pure, uniform.

Check your processing room equipment today . . . replace inefficient articles with Eastman, and standardize on Eastman Prepared Processing Powders, to be certain you are ready to meet the unusual requirements of hot-weather processing.

EASTMAN KODAK COMPANY

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WILSON'S CO-RE-GA

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THE PERFECT ADHESIVE FOR DENTURES

Wilson's CO-RE-GA is Used and Prescribed very extensively by full Denture Prosthetists. Holds Dentures Firmly and Comfortably in Place while your Patients are Learning to Wear them

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THE TRIAL SIZE COREGA IS FURNISHED FREE TO DENTISTS

Mail the Coupon for **YOUR SUPPLY**

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Caustic, Astringent, and Antiseptic

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Powerful Disinfectant for Gangrenous Pulp

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Powerful Astringent, Stimulant, and Bactericide

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Counterirritant and Sedative

PHENOL COMPOUND, LILLY
Anodyne, Antiseptic, and Disinfectant

THYMOLIZED CALCIUM PHOSPHATE, LILLY
A Pulp-Capping and Filling for Small Root Canals

A pamphlet by Dr. Buckley, giving information on these preparations, will be sent to any dentist on request.

SUPPLIED THROUGH THE DRUG TRADE

ELI LILLY AND COMPANY

INDIANAPOLIS, U. S. A.

Food

TASTES BETTER

▲ ▲ ▲ when the mouth is clean and accumulations are removed from the teeth.

Those unfortunate people who did not learn years ago how to preserve their teeth and must now wear artificial dentures may again enjoy the delicate tastes of good food.

Mechanical cleansing of dental plates by scrubbing with Arm & Hammer Baking Soda, water, and a good brush, removes the deposits and accumulations and aids in correcting the bad taste and fetid breath.

Some forms of stomatitis (sore mouth) may be prevented by washing the teeth morning and evening with Baking Soda and water, and rinsing the mouth with soda water (one teaspoonful of soda to a glass of water) after each meal.

If artificial teeth are not worn at night time, they should be allowed to stand in a glass of water in which one teaspoonful of soda has been dissolved.

Arm & Hammer and Cow Brand Baking Sodas are identical. Both are bicarbonate of soda in its purest form.

ACCEPTED AMERICAN DENTAL ASSOCIATION COUNCIL ON DENTAL THERAPEUTICS

Soda is an effective and economical dentifrice for both natural and artificial teeth.

It cleans the teeth.

Business Established in the Year 1846

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Exclusively Engaged
in providing

Professional Protection

Thirty-three Years
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The Medical Protective Company
of Fort Wayne, Ind.
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Bright Smiles Win Prizes Worth

$25,000.00

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PRIZES EVERY
WEEK

SMILE
AMERICA
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ENTER TODAY

—*full details at your druggist*

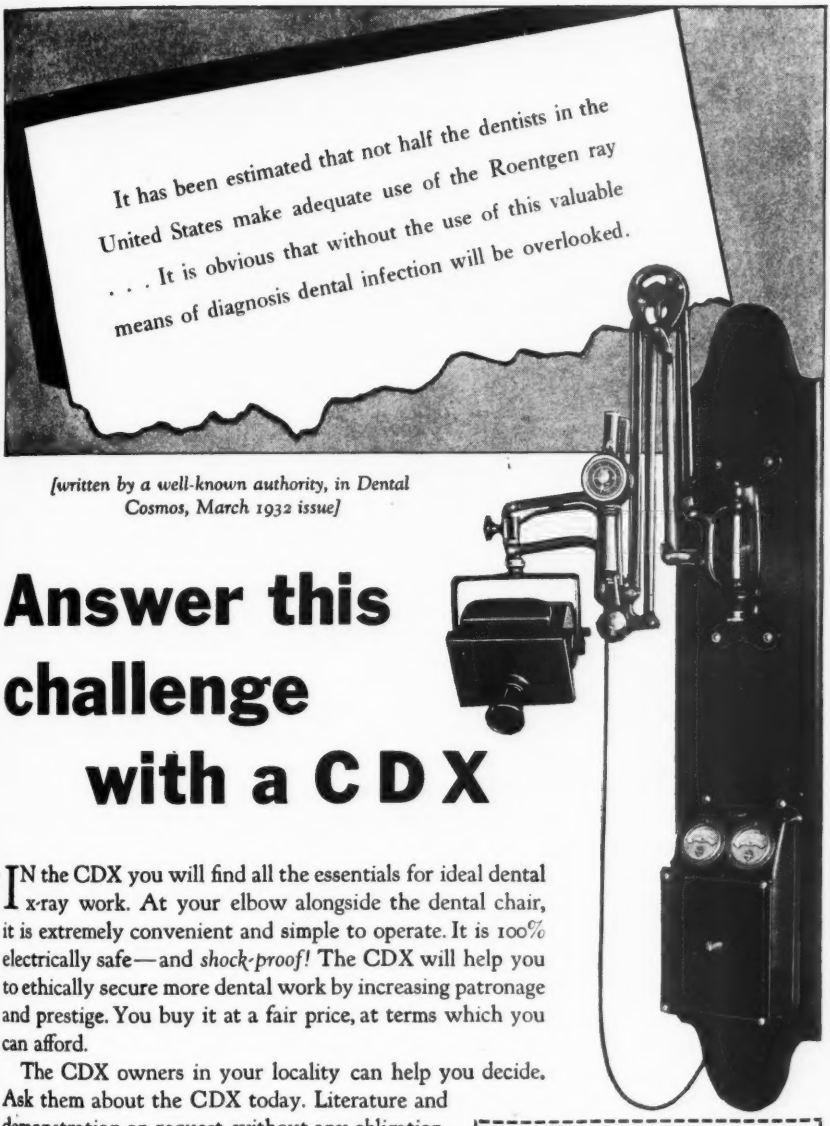
373 prizes every week for 12 weeks—4,477 prizes in all—including wonderful home movie outfits and thousands of other Agfa Ansco cameras.

And all you have to do is *just send a snapshot* of any smiling face—your own—the baby's—the fruit peddler's—anyone's smile—addressed to The Iodent Company, Detroit. Put your name and address and the name and address of your druggist on the back of the picture. *Also include an empty* IODENT TOOTH PASTE *carton (No. 1 or No. 2) or a hand drawn facsimile of either.* Contest closes midnight August 6th. In the event of a tie, the advertised awards will be paid to each of the tying contestants.

Take your pictures with any camera—on any film—any size—a little box camera snapshot will do nicely. Don't mount them or color them—size or photographic quality doesn't count. It's the smile that will win. Anyone can do it—no study—no writing—just go smile hunting. It will be fun for the whole family. See your druggist for more complete details.

MAY 15 - - - TO - - - AUGUST 6

IODENT *Agfa*
$25,000 *Smile* CONTEST


It has been estimated that not half the dentists in the United States make adequate use of the Roentgen ray . . . It is obvious that without the use of this valuable means of diagnosis dental infection will be overlooked.

[written by a well-known authority, in Dental Cosmos, March 1932 issue]

Answer this challenge with a CDX

IN the CDX you will find all the essentials for ideal dental x-ray work. At your elbow alongside the dental chair, it is extremely convenient and simple to operate. It is 100% electrically safe—and *shock-proof!* The CDX will help you to ethically secure more dental work by increasing patronage and prestige. You buy it at a fair price, at terms which you can afford.

The CDX owners in your locality can help you decide. Ask them about the CDX today. Literature and demonstration on request, without any obligation.

Radiography First—then Dental Care

Dental Department

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FORMERLY VICTOR X-RAY CORPORATION

Join us in the General Electric program broadcast every Sunday afternoon over a nationwide N. B. C. network

General Electric X-Ray Corporation
Dental Department
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Please send me complete details regarding the CDX, also your deferred payment plan.

Dr......

Address.....

Dealer.....

126

Balanced!

Suspend a Sani-Terry Handpiece with a string or balance it on the edge of a knife or ruler. The point of balance is just where the handpiece is naturally grasped and held when it is in use.

•

There is less fatigue after a day's use of the Sani-Terry Handpiece. It is 20% lighter in weight than the usual cord handpiece and there is a better distribution of weight so that there is no backward pull on the hand from a too heavy wrist joint. The sheath is the right size for a comfortable hold and the knurled portion gives the fingers a firm, easy grasp.

•

20% LESS WEIGHT

Sani-Terry Cord Handpieces are accurate, true-running and very resistant to wear. The Sani-Terry Contra-Angle, too, offers the utmost in handpiece convenience and service. Full particulars about both will be sent on request.

Have your handpieces repaired where handpieces are made! All of the facilities of our handpiece department, both skill and equipment, are available for handpiece repairs.

THE CLEVELAND DENTAL MFG. CO.

Makers of fine dental instruments, forceps and pliers

CLEVELAND, CLEV-DENT OHIO, U. S. A.

MINDS

Keen EYES *Skilled* FINGERS

For over 30 years it has been our privilege to work prosthetically with thousands of dentists throughout the United States, and in our capacity as craftsmen we have had an unequalled opportunity to gain experience.

The benefit of this experience and contact with men in practice, and those engaged in dental research and manufacturing is offered to our clients. At the Home of Oral Art, you will find trained minds, keen eyes and skilled fingers to construct all kinds of restorations and appliances, and to offer suggestions relative to design on request.

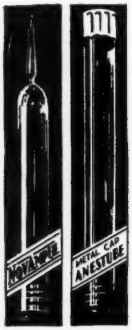
Distances are short today—we are but a few "mail hours" distant from your office — our resources enable us to provide the finest type of construction at low cost.

HENRY P. BOOS

Send Me Literature **DENTAL LABORATORIES,** ***Minneapolis***

Dr._____ **Address**_____

The "Quantity" and "Intensity" Factors In Novol 75 Anesthetic Solution



THE amount of alkali necessary to neutralize an acid is known in chemistry as the "quantity factor" (called erroneously "potential acidity") and does not represent the true measure of acidity. It is the free hydrogen ions that determine the intensity and corrosive action of the acid. This is known as the "intensity factor."

For example, one molecule of hydrochloric acid (HCl) requires one molecule of sodium hydroxide (NaOH) for neutralization. But three molecules of sodium hydroxide are necessary to neutralize one molecule of boric acid (H_3BO_3). The so-called "potential acidity" of boric acid is therefore three times as great as that of hydrochloric acid.

Yet, who will question the fact that hydrochloric acid is much more acid and terrifically more destructive than boric acid, universally used as an eye wash. While the "quantity factor" of boric acid is greater than that of hydrochloric acid, the "intensity factor" of hydrochloric acid is ten thousand times as great.

Similarly, the "intensity factor" of unbuffered strongly acid local anesthetics with a *p*H of dead tissue (3.8), is nearly one thousand times that of the new improved Novol 75 Anesthetic Solution with *p*H approaching that of the living tissue (6.7).

Anesthesia is rapidly established with the new improved Novol 75 Anesthetic Solution because neutralization is instantaneous upon injection on account of the very low "intensity factor." The solution diffuses quickly.

Tissue lesions are avoided because there are no free hydrogen ions to bombard and destroy the living tissue cells until neutralization is completed.

Toxicity is minimized because the peripheral blood vessels are not irritated and dilated. The epinephrin immediately contracts the muscle coat of the blood vessels and prevents absorption into the circulation.

Use the new improved Novol 75 Anesthetic Solution in your practice. It is isotonic, isosmotic, non-hemolytic and bacteriostatic.

A booklet "The True Facts about Novol 75 Anesthetic Solution" is now ready. It gives true facts based not only on researches in our laboratories but on clinical findings as well. A copy is yours for the asking. If you will indicate the type of container you now use and strength of formula, we shall be glad to send samples.

Novocol Chemical Mfg. Co., Inc.
2921-23 Atlantic Ave., Brooklyn, N. Y.

Please send me a copy of your booklet "The True Facts about Novol 75 Anesthetic Solution."

Name.....

Address .....

NOVOCOL CHEMICAL MFG. CO., INC.
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Makers of *Novol* Products
Oakland, Cal. Toronto, Can.

The more critical you are about results the more satisfied you will be with Lavoris.

A specific for purging germ laden mucus from mouth and throat—a stimulant to local circulation — a non-irritant to tissue. In addition, Lavoris has the very desirable quality of being pleasing.

We maintain no periodical sampling lists but gladly send to the profession a complimentary supply on request.

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Minneapolis - Minnesota

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FLECK'S CEMENT HOLE-IN-ONE CLUB

ANNOUNCING THE FIFTH ANNUAL SEASON

Club membership now 148 dentists. Top score held by Doctor George O. Cruikshank of Sewickley, Pa., whose heaven-directed swat made the ball fly 292 yards ere it settled in the cup. There's a mark for you golfing Doctors. Fore!

MAKE A HOLE-IN-ONE

BEFORE THE END OF AUGUST AND WIN A BOX OF

FLECK'S CEMENT

SIMPLY HAVE YOUR CLUB SECRETARY O. K. SCORE CARD AND MAIL

MIZZY, INC., Distributors, 105-107 EAST 16th ST., NEW YORK

Capacity TO PAY . . .

MEMBERSHIP *limited to ethical* PHYSICIANS SURGEONS and DENTISTS

IN these days when we hear so much of the suggestion that the liability under any treaty, contract or agreement should be determined by "the capacity to pay," it is important that any insurance company should have sufficient sound assets to enable it to pay all obligations in full.

It is with a feeling of pride and satisfaction that we present the report showing unencumbered assets exceeding $1,000,000.00 at the close of thirty years' continuous operation, under the same management.

In 1931 we paid for sick and accident claims over $528,000.00, saved and invested for future protection over $56,000.00, making over $584,000.00 used for benefits out of the $638,000.00 collected from the members (over 91%).

PHYSICIANS CASUALTY ASSOCIATION
PHYSICIANS HEALTH ASSOCIATION
Omaha, Nebraska

E. E. ELLIOTT SECRETARY TREASURER

Dioxogen

The value of Dioxogen in Dental work is due to its disinfecting, cleansing, styptic and deodorizing properties.

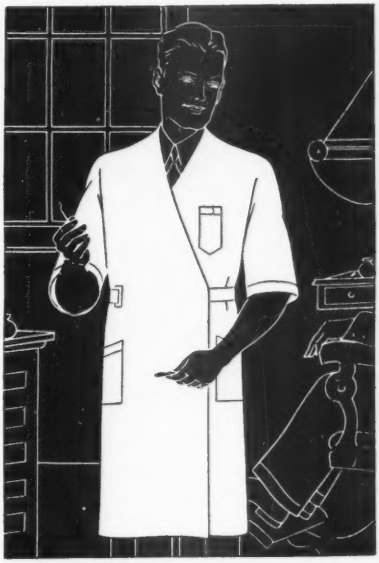
This unusual combination of desirable qualities in one harmless product seems to fit it peculiarly for use in the mouth; disinfectants as strong as Dioxogen are not usually harmless.

Dentists who are familiar with Dioxogen regard it as one of their most efficient aids; in fact, not a few dentists have said they did not know how they would get along without it.

A sample will be sent gladly on request.

The Oakland Chemical Company

59 Fourth Avenue
NEW YORK, N. Y.



DOCTOR:

Here's Summer Comfort for only **$1.70**

Proper clothing is the first essential to summer comfort. You will find this neat, easy-fitting Dental Smock ideal for professional wear during the warm weather. It is made of fine twill, with a reversible front that quickly turns under when soiled. Price, delivered (Style 323, white), only $1.70 each or 3 for $4.70. In grey (Style 323G) and (Style 323N), each $2.00. Small, medium and large sizes.

When you remit full amount with order, we pay the carrying charges in the U. S. Our Professional Catalog picturing other styles sent free on request. Address branch nearest you.

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CHICAGO—175 N. Michigan, Dept. W
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ANGELICA
ANGELICA JACKET CO.
DENTAL SMOCKS
STANDARD OF THE WORLD SINCE 1878

Consider the Patients' Comfort

•

IT WILL PAY YOU

•

The simpler the operation the less pain and discomfort is expected by the patient. You can make the polishing of the teeth an agreeable operation and one that will give you satisfaction as well as the patient.

BS Polishers are the right shape and size to clean not only the exposed surface but also under the free margin of the gums and much of the proximal surfaces. Made of soft resilient rubber vulcanized to metal screws. No exposed metal is rotated, not even any disagreeable splashing.

You owe yourself a trial of the best in engine polishers, BS Polishers, The Gentle Polishers with Pep.

May we send sample BS Polisher and interesting reprint:

"Research in Subgingival Therapy"

YOUNG DENTAL MFG. CO.
4958 Suburban' R. W., St. Louis

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ADVENTURES IN HEALTH

featuring

DR. HERMAN N. BUNDESEN
President Chicago Board of Health

THE MOST UNUSUAL FEATURE ON THE AIR IN HEALTH EDUCATION —DRAMATIZED

Wednesdays and Fridays
COLUMBIA NETWORK

9:15 P. M. Eastern Stan. Time — 8:15 P. M. Central Stan. Time
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Horlick's the Original Malted Milk
The Great American Food-Drink for All Ages
RACINE, WIS.

Use ZOALITE
INFRA-RED RADIATION

For restoring normal circulation
—for destroying infection
—for prompt relief of pain

THE BURDICK CORPORATION
Dept. 440 MILTON, WIS.
You may send complete information on the Zoalite's value in dentistry.
Dr._____
Street_____
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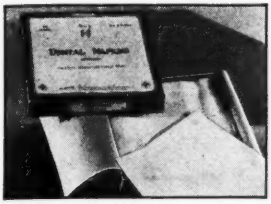
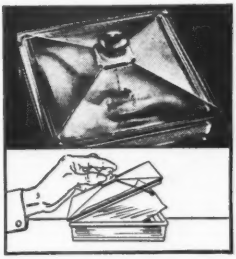
RESULTS

of direct mail advertising depend on the address list.



J & J ASEPTIC DENTAL NAPKINS

J & J Aseptic Dental Napkins meet every requirement of modern dental practice for an absorbent napkin that is surgically clean and can be discarded after use. These attractive napkins are made of soft, snow white gauze, woven for the purpose, and extremely absorbent. You will like them. Your patients will appreciate your consideration.



A NAPKIN DISH with napkin pick-up for dispensing dental napkins. Very convenient. Picks up one napkin at a time. Ask your dealer to show it to you.

COTTONOID — a snow white, soft, felted absorbent cotton. This is a convenient form of cotton which may be cut into pellets or strips, or used with the dental napkin to increase its absorbent capacity.

It is to your advantage as well as to your patients, to use J & J Dental Products in your everyday practice . . . each is manufactured under strict conditions of surgical cleanliness. Order direct or through your dental dealer.

Johnson & Johnson
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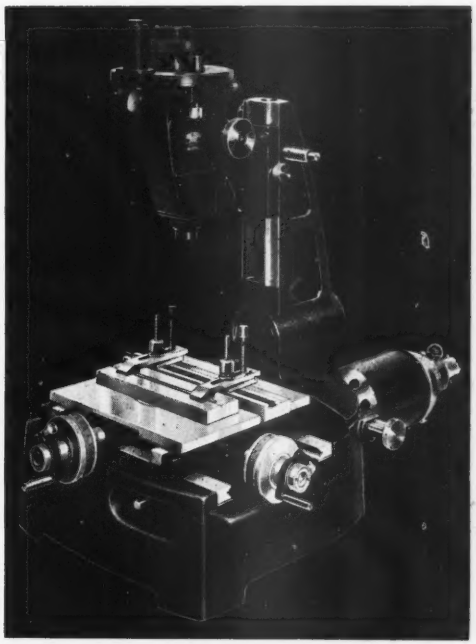

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